LIFSHITS, I. M.

USSR/Mathematics - Perturbation Theory, Quantum Statistics Jan/Feb 52

"A Problem in the Perturbation Theory Connected With Quantum Statistics," I. M. Lifshits.

"Uspekh Matemat Nauk" Vol VII, No 1 (47), pp 171-180

Quantum statistics and crystal theory have the problem of computing the spur (trace) of the operator Sp (F(L+A)-F(L). Solves a similar problem for an arbitrary degenerate perturbation operator A without using any usual requirement of "smallness" of A. Gives example of the computation of free energy of a solid soln. Submitted 7 May 51.

204T30

LIFSHITS, I.M.

USSR/Physics - Thermodynamics Apr 52

"Thermal Capacity of Thin Films and Needles at Low Temperatures," I. M. Lifshits, Phys Tech Inst, Acad Sci Ukrainian SSR

"Zhur Eksper i Teoret Fiz" Vol XXII, No 4, pp 471-474

Shows that bended waves, with the dispersion law $\omega \sim k^2$, propagating in thin films and needles have a peculiar thermal dependence of heat capacity at sufficiently low temp. For thin needles it is $C \sim T^{1/2}$, and for thin films it is $C \sim T$. Received 19 Nov 51.

215T84

USSR/Physics - Thermodynamics Apr 52

"Thermal Properties of Catenary (Chain) and Laminar Structures at Low Temperatures," I. M. Lifshits, Phys Tech Inst, Acad Sci Ukrainian SSR

"Zhur Eksper i Teoret Fiz" Vol XXII, No 4, pp 475-486

Investigates subject taking into account results obtained by author for thin films. Basic method consists in finding the dispersion law of long-wave spectrum band of oscillations of laminar crystal as a whole in an approximation in which,

215T85

besides eqs of elasticity theory of strongly anisotropic body, the transversal rigidity of sep atomic layers or chains is taken into account. Results are used for studies of thermodynamic coeffs. Indebted to A. A. Galkin. Received 19 Nov 51.

215T85

LIFSHITS, I.M.

LIFSHITS, I. M.

USSR/Engineering - Vacuum Pumps Aug 52

"Theory of Steam-Jet Vacuum Pumps," I. M. Lifshits, L. N. Rozentsveyg

"Zhur Tekh Fiz" Vol 22, No 8, pp 1362-1375

Studies a simple model of steam-jet pump. Derives formulas and curves giving the velocity of evacuation and the limit of obtainable vacuum at various values of parameters, characterizing the jet. Indebted to K. D. Sinelnikov. Received 13 May 52.

226T38

LIVSHITS, I. M.

Thermochemistry

Remarks on I. M. Livshits' works: "Thermal properties of chain and layer structures at low temperatures" and "Heat capacities of thin films and acicular-shaped bodies." V. V. Tarasov. Zhur. fiz, khim. 26 no. 5, 1952.

Monthly List of Russian Accessions, Library of Congress, November 1952. Unclassified.

Lifshits, I.M.

USSR.

✓ Contribution to the Theory of Local Fusion. I. M. Lifshits and L. S. Gulida (*Doklady Akad. Nauk S.S.S.R.*, 1952, 87, (3), 377-380) [In Russian]. A math. theory is developed of the occurrence of local fusion due to a source of heat inside the solid, the surface temp. being such as to preclude the possibility of fusion from the surface. It is shown that, in individual regions, the temp. can be so high that the occurrence of local fusion-nuclei, due to fluctuation, is possible. The experimental work of Khaykin and Bene (*ibid.*, 1939, 23, 31) shows the occurrence of fusion inside the solid phase of polycryst. Sn bars, while in Sn single crystals superheating to the extent of 1·5°-2° C. occurred. (Fulmer Research Institute Translation No. 56.)—J. S. G. T.

Khar'kov State U. im. Gor'kiy

LIFSHITS, I.M.

The development of nuclei of local melting. L. S. Gulida and I. M. Lifshits (A. M. Gor'kii State Univ., Kharkov). *Doklady Akad. Nauk S.S.S.R.* 87, 823–6 (1952).—This is a theoretical study in which L. and G. (*C.A.* 50, 2220d) continue their consideration of the thermodynamic potential of an isotropic solid phase contg. drops of liquid nuclei. At const. vol. this local melting occurs at a much lower temp. than general complete melting. In the *P-T* diagram there is a region of metastable existence of a solid phase with liquid nuclei sprinkled through it. V. H. Gottschalk

1. LIFSHITS, I. M.

2. USSR (600)

4. Thermochemistry

7. V. V. Tarasov's theory of heat capacities and his remarks concerning my work in this field, Zhur. fiz. khim., 27, No. 2, 1953.

9. Monthly List of Russian Accessions, Library of Congress, April, 1953, Uncl.

LIFSHITS, I. M.
USSR.

537.312.62

3198. Kinetics of destruction of superconductivity by an alternating field ($\omega \lesssim \sim 10^6$ sec^{-1}). I. M. LIFSHITS AND M. I. KAGANOV. *Dokl. Akad. Nauk SSSR*, 90, *No.* 3, 361–6 (1953) *In Russian.* English translation, *U.S. National Sci. Found. NSF-tr-114.*

In experiments by Lazarev and Galkin and others a steady magnetic field and an alternating one are superimposed on a superconductor so that during part of each period the field exceeds the critical value; destruction of superconductivity takes place by the movement into the metal of a boundary between superconducting and normal phases. The kinetics of this process is discussed, taking into account both the possibility of relaxation effects and of superheating. The discussion is limited to frequencies <1 Mc/s, so that mean-free-path effects are unimportant, and expressions are given for the depth of the boundary as a function of time for various limiting conditions. See also Abstr. 1016 (1952). D. SHOENBERG

LIFSHITS, I.M.

Nuclear Sci Abs
V-8 Jan 15, 1954
Physics

KINETICS OF THE DESTRUCTION OF SUPERCONDUCTIVITY BY A HIGH FREQUENCY FIELD. I. M. Lifshits and M. I. Kaganov. Translated from Doklady Akad. S.S.S.R. 90, 529-31(1953). 3p. (NSF-tr-91)

The kinetics of the destruction of superconductivity by an alternating field with frequency $\omega \gtrsim 10^8$ sec^{-1} was investigated. A kinetic equation was derived from the Maxwell equations limited by certain boundary conditions: $-\partial H/\partial z = (-4\pi/c)J$; $\partial E/\partial z = (-1/c)(\partial H/\partial t)$; $H|_{z=0} = H_0(\omega t)$; $E|_{z=\zeta(t)} = H_k(\zeta'(t)/c)$; and $d\zeta/dt = (H(\zeta) - H_k)/H_k)\nu_0$. (J.S.R.)

6/22/54

LIFSHITS, I. M.

USSR/Physics - Magnetic Susceptibility, 1 Aug 53
Low Temperatures

"Theory of Magnetic Susceptibility of Thin Metallic Layers at Low Temperatures," I. M. Lifshits and A. M. Kosevich, Phys-Tech Inst, Acad Sci Ukr SSR, Khar'kov State Univ im Gor'kiy

DAN SSSR, Vol 91, No 4, pp 795-798

Study magnetic properties of a metallic layer of finite thickness. The usual assumption is made of electron gas between two infinitely high "potential walls." Obtain formulas that

272T86

facilitate study of arbitrary thickness of film. Presented by Acad L. D. Landau 5 Jun 53.

USSR/Physics - X-Ray Background 1 Nov 53

FD 419

USSR/Physics - Energy spectrum

Card 1/1 Pub. 147-5/16

Author : Lifshits, I. M.

Title : Determining the energy spectrum of a Bose system from its heat capacity

Periodical : Zhur. eksp. i teor. fiz. 26, 551-556, May 1954

Abstract : Studies the possibility of determining the energy spectrum of a Bose system from its heat capacity. Solves analytically this problem. Shows that the formal solution of the obtained integral equation is instable; however, the "smoothed" spectral density of stability, which is of physical interest, can also be constructed from experimental data in principle with the desired degree of accuracy. Thanks L. D. Landau, V. A. Marchenko, and M. G. Kreyn for their discussions.

Institution : Physicotechnical Institute, Academy of Sciences Ukrainian SSR

Submitted : November 2, 1953

LIFSHITS, I. M.
USSR/ Physics

Card : 1/1

Authors : Lifshits, I. M., and Kosevich, A. M.

Title : On the theory of the de Haas - van Alphen effect for particles with arbitrary law of dispersion

Periodical : Dokl. AN SSSR, 96, Ed. 5, 963 - 966, June 1954

Abstract : The periodical dependence of magnetic susceptibility upon the field at low temperatures (the de Haas - van Alphen effect) is observed for a large number of metals. The quantitative theory of this phenomenon was developed for electron gas with quadratic law of dispersion which is good only at the bottom of an energy level zone. The article analyzes conditions under which the quadratic dispertion mentioned above is good and it comes to the conclusion that such an assumption is without a resonable base. Four references.

Institution : Acad. of Sc. Ukr-SSR, Physico-Techn. Institute

Presented by : Academician, L. D. Landau, March 15, 1954

LIFSHITS, I. M.

USSR/Physics - Electronics

Card : 1/1

Authors : Lifshits, I. M. and Pogorelov, A. V.

Title : Determination of the Fermi surface and electron speeds in metal by the oscillations of magnetic susceptibility

Periodical : Dokl. AN SSSR, 96, Ed. 6, 1143 - 1145, June 1954

Abstract : A study of the de Haas-van Alphen effect for particles with arbitrary dispersion law showed that the periods and amplitudes of the magnetic moment oscillation are connected with the form of the Fermi boundary surface for electron in the metal. By knowing the form of that surface one can find the volume and consequently the number and speed of electrons in the corresponding zone. The magnetic susceptibility oscillations in the zone of not too large fields ($H \sim 10^{-4}$ Gauss) are connected only with zones having an abnormally small number of electrons. One reference.

Institution : Acad. of Sc. Ukr-SSR, Physico-Technical Institute

Presented by : Academician L. D. Landau, March 15, 1954

LIFSHITS, I. M.

USSR/Physical Chemistry - Crystals, B-5

Abst Journal: Referat Zhur - Khimiya, No 1, 1957, 190

Author: Lifshits, I. M., and Stepanova, G. I.

Institution: Lvov University

Title: On the Energy Spectrum of the Oscillations of Random Crystals

Original Periodical: Fiz. sb. L'vovsk. un-ta, 1955, Vol 1, No 6, 84-94

Abstract: A method is proposed for the calculation of the spectral intensity of the oscillations of the atoms of a lattice composed of different isotopes of the same element. An idealized simple lattice is discussed in which all the oscillations occur in the same direction.

Card 1/1

LIFSHITS, I.M.; ITSKOVICH, F.I.

Kinetics of superconductivity breakdown brought forth by a variable field. Uch.zap. KHGU no.6:45-57 '55. (MLRA 10:7)
(Superconductivity)

LIFSHITS, I.M.; KOSEVICH, A.M.

Oscillations in the thermodynamic values for a degenerated Fermi-gas at low temperatures. Izv. AN SSSR.Ser.fiz.19 no.4:395-403 Jl-Ag '55. (MLRA 9:1)
(Low temperature research) (Electrons)

FD-3212

LIFSHITS, I. M.

USSR/Physics, Applied-Vacuum Pumps

Card 1/1 Pub. 153-21/28

Authors : Lifshits I. M. and Rozentsveyg L. N.

Title : Theory of vapor stream vacuum pumps

Periodical : Zhur. Tekh. Fiz., 25, No 7, 1323-1325, 1955

Abstract : Polemics concerning an article published by the authors in 1952 (ZhTF, 24, 1362 (1952)). The authors answer criticism by V. I. Skobelkin and N. I. Yushchenkova (ZhTF, 24, 1879 (1954)) and attempt to justify their theoretical assumptions. References as above.

Institution: ---

Submitted : January 28, 1955

FD-2086

USSR/Physics - Helium II

Card 1/1 Pub. 146 - 23/26

Author : Lifshits, I. M.; Kaganov, M. I.

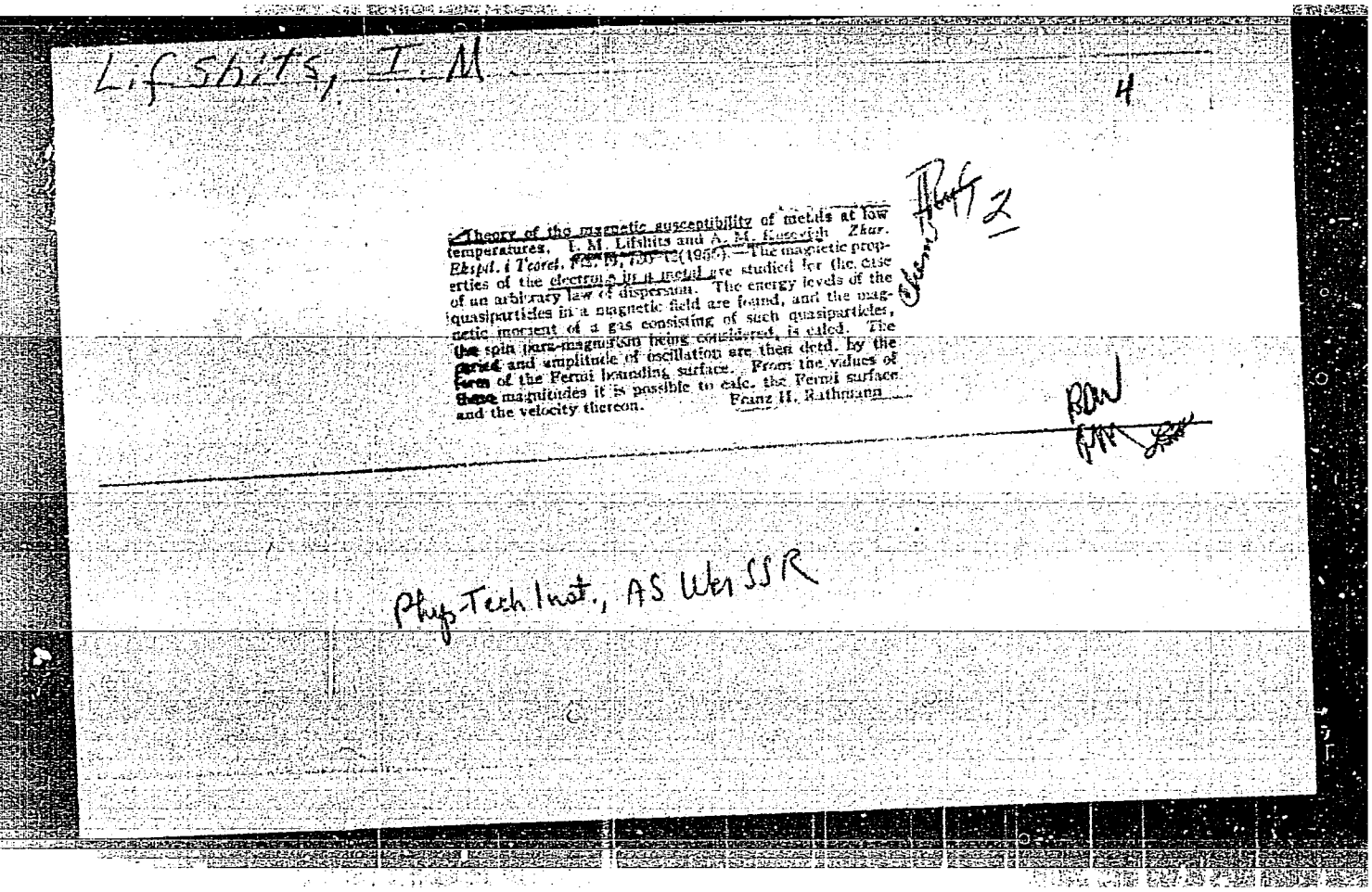
Title : Effective density of rotating liquid helium II

Periodical : Zhur. eksp. i teor. fiz., 29, August 1955, 257-258

Abstract : As has been shown (L. D. Landau, Ye. M. Lifshits, DAN SSSR, 100, 669, 1955), during rotation of a container with helium II the normal part of the helium mass rotates as a whole, but relative to the superfluid motion the cylindrical volume of liquid is resolved into a number of coaxial cylindrical layers in each of which superfluid motion holds with velocity distributed according to the law: $v_s^i = b_i/r$, $b_i = W(r_i^2 - r_{i+1}^2)/(2 \cdot \ln[r_i/r_{i+1}])$, where the values of the radii of the boundaries of separation are determined for two limiting cases of slow and fast rotation. In the present note the writers make more precise these limiting cases, and study the dependence of effective density upon angular velocity W for various temperatures. Two references: e.g. Ye. M. Lifshits, Sverkhtekuchest' (teoriya) [Superconductivity (Theory)], supplement to monograph of Keesom, Foreign Literature Press, 1949.

Institution : Physicotechnical Institute, Academy of Sciences Ukrainian SSR, Khar'kov

Submitted : March 31, 1955



Lifshits, I. M.

4

Theory of the magnetic susceptibility of metals at low temperatures. I. M. Lifshits and A. M. Kosevich. *Zhur. Eksptl. i Teoret. Fiz.* 29, 730-42(1955).—The magnetic properties of the electron gas in a metal are studied for the case of an arbitrary law of dispersion. The energy levels of the quasiparticles in a magnetic field are found, and the magnetic moment of a gas consisting of such quasiparticles, the spin para-magnetism being considered, is calcd. The period and amplitude of oscillation are then detd. by the form of the Fermi bounding surface. From the values of these magnitudes it is possible to calc. the Fermi surface and the velocity thereon. Franz H. Rathmann

Phys-Tech Inst., AS Ukr SSR

LIFSHITS, I.M.

FD-3244

USSR/Physics - Magnetism

Card 1/1 Pub. 146 - 3/44

Author : Kosevich, A. M.; Lifshits, I. M.

Title : The De Haas-Van Alphven effect in thin layers of metals

Periodical : Zhur. eksp. i teor. fiz., 29, No 6(12), Dec 1955, 743-747

Abstract : Considered are the magnetic properties of electrons in thin metal layers in the case of an arbitrary law of dispersion. The authors determine the energy levels of quasiparticle with arbitrary law of dispersion in a magnetic field in the presence of a perpendicular potential field. They calculate the oscillating part of the magnetic moment of the gas of such quasiparticles, and utilize the general formulas for an investigation of the De Haas-Van Alphven effect in thin layers of metals. It is shown that the periods and amplitudes of oscillations are determined by the shape of the Fermi boundary surface and depend essentially upon the ratio of the thickness of the layer and the "radius of the classical orbit" of the quasiparticle. Two references.

Institution : Physicotechnical Institute, Academy of Sciences of Ukrainian SSR

Submitted : July 19, 1954

APPROVED FOR RELEASE: 07/12/2001 CIA-RDP86-00513R000929910003-8"

LIFSHITS, I.M.

ROSENTSVEYG, L.N.; LIFSHITS, I.M.; LEYKIN, G.A.; KONDRAT'YEV, V.N.

Nobel prizes for 1954 in the fields of physics and chemistry. (MLRA 9:1)
Priroda 44 no.12:37-41 D '55.

1.Chlen-korrespondent AN USSR (for Lifshits)
(Nobel prizes) (Physicists) (Chemists)

LIFSHITS, I.M.

6

707* Tamm's Bound States of Electrons on the Surface of a Crystal and the Surface Vibrations of Atoms in the Lattice. Tammovskie svizannye sostoianiia elektronov na poverkhnosti kristalla i poverkhnostnye kolebaniia atomov reshetki. (Russian.) I. M. Lifshits and S. I. Pekar. *Uspekhi fizicheskikh nauk*, v. 56, no. 4, Aug. 1955, p. 531-568.
Mathematical and theoretical study. Diagrams, graphs. 68 ref.

PR

(1)

LIFSHITS, I. M.

Category : USSR/Solid State Physics - Solid state theory. Geometric crystallography E-2

Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 1046

Author : Lifshits, I.M., Peressda, V.I.
Title : On the Theory of Scattering of Quasi-Particles with Arbitrary Dispersion Law.

Orig Pub : Uch. zap. Khar'kovsk. un-ta, 1955, 64, 37-43

Abstract : Calculation of the waveforms, surfaces, amplitudes of scattered waves, and effective scattering cross sections of quasi-particles with arbitrary dispersion law, scattered by local irregularities. It is established that (1) the scattering wave is in general a superposition of several waves, (2) the amplitude of the wave depends on the law of dispersion and on the pecularities of the scattering center, (3) the form of the scattered wave depends on the dispersion law, and (4) there may be isolated directions, in which the scattered wave diminishes slower than the reciprocal of the distance

Card : 1/1

LIFSHITS, I.M.

D-5

Category : USSR/Atomic and Molecular Physics - Low-Temperautre physics

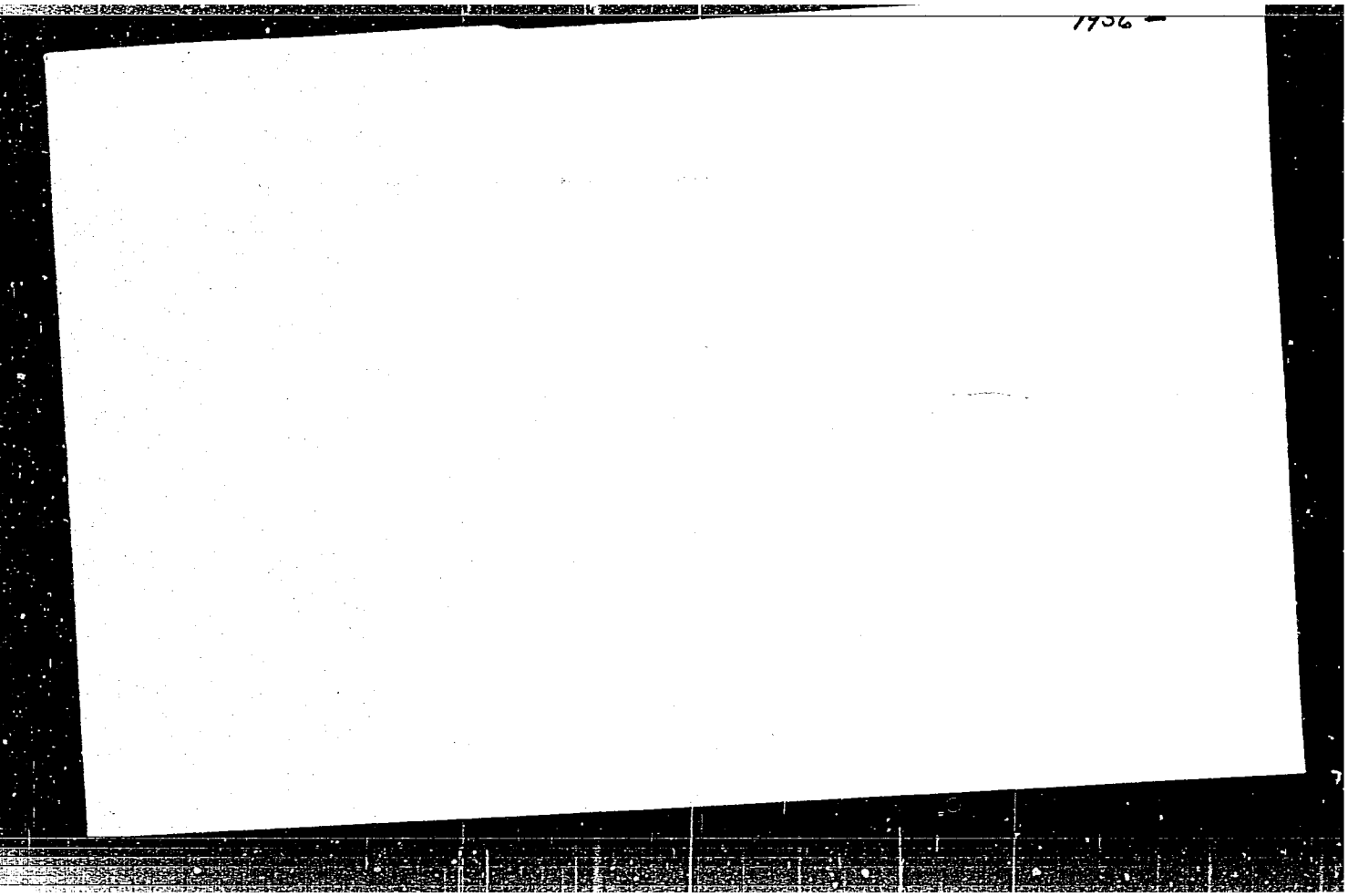
Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 897

Author : Lifshits, I.M., Itskevich, F.I.
Title : On the Kinetic Destruction of Superconductivity by an Alternating Field.

Orig Pub : Uch. zap. Khar'kovsk. un-ta, 1955, 64, 45-57

Abstract : The theory of the kinetics of the destruction of superconductivity by an alternating field, developed by I. M. Lifshits (Zh. eksperim. i teor. fiziki, 1950, 20, 834; Referat. Zhurnal Fizika, 1956, 6727) is generalized to take into account the curvature of the speciment and thermal effects. It is shown that the maximum thickness of the normal layer is greater for a cylindrical specimen than for a plane one. The average relaxation speed increases in the same ratio. The authors start with the equation of heat balance to take into account the thermal effects. The resultant equation of motion of the boundary is integrated for the cases of isothermal and adiabatic modes.

Card : 1/1



LIFSHITS, I. M., AZBEL, M. I. and KAGANOV, M. I. (Khar'kov)

"On the Theory of Galvanomagnetic Phenomena," paper presented at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, USSR, 23-31 May 1956.

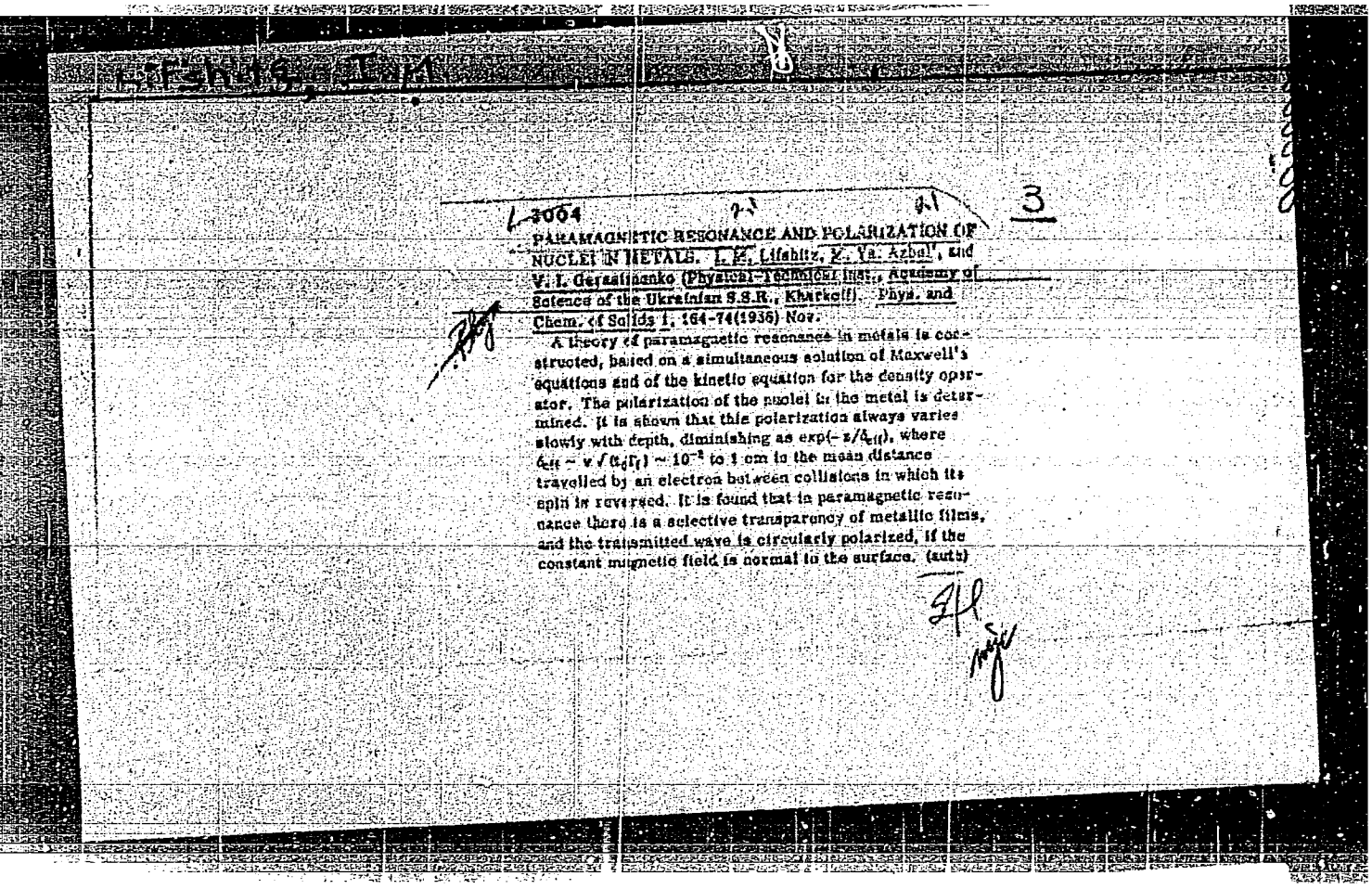
LIFSHITS, I. M., KOSEVICH, A. M., and POGORELOV, A. V. (Khar'kov)

"The Energy spectrum of Electrons in Metals and the De-Haas-van Alphen Effect," a paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 56.

OMEL'YANOVSKIY, M.E., otvetstvennyy redaktor; SINEL'NIKOV, K.D., redaktor; LIFSHITS, I.M., redaktor; OSTRYANIN, D.F., doktor filosofskikh nauk, redaktor; PASECHNIK, M.V., kandidat fiziko-matematicheskikh nauk, redaktor; SHUGAYLIN, A.V., kandidat filosofskikh nauk, redaktor; AGUF, M.A., redaktor izdatel'stva; SIVACHENKO, Ye.K., tekhnicheskiy redaktor

[Philosophical problems in modern physics] Filosofskie voprosy sovremennoi fiziki. Kiev, 1956. 250 p. (MLRA 10:1)

1. Akademiya nauk URSR, Kiyev. 2. Deystvitel'nyy chlen AN USSR (for Omel'yanovskiy, Sinel'nikov) 3. Chlen-korrespondent AN USSR (for Lifshits)
(Physics--Philosophy)



L 3004 3

PARAMAGNETIC RESONANCE AND POLARIZATION OF NUCLEI IN METALS. I. M. Lifshitz, M. Ya. Azbel', and V. I. Gerasimenko (Physical-Technical Inst., Academy of Science of the Ukrainian S.S.R., Kharkoff). Phys. and Chem. of Solids 1, 164-74(1956) Nov.

A theory of paramagnetic resonance in metals is constructed, based on a simultaneous solution of Maxwell's equations and of the kinetic equation for the density operator. The polarization of the nuclei in the metal is determined. It is shown that this polarization always varies slowly with depth, diminishing as $\exp(-z/\delta_{\text{eff}})$, where $\delta_{\text{eff}} \sim v\sqrt{(t_1 t_2)} \sim 10^{-3}$ to 1 cm is the mean distance travelled by an electron between collisions in which its spin is reversed. It is found that in paramagnetic resonance there is a selective transparency of metallic films, and the transmitted wave is circularly polarized, if the constant magnetic field is normal to the surface. (auth)

LIFSHITS, I.M.

E-7

Category : USSR/Solid State Physics - Morphology of Crystals. Crystallization

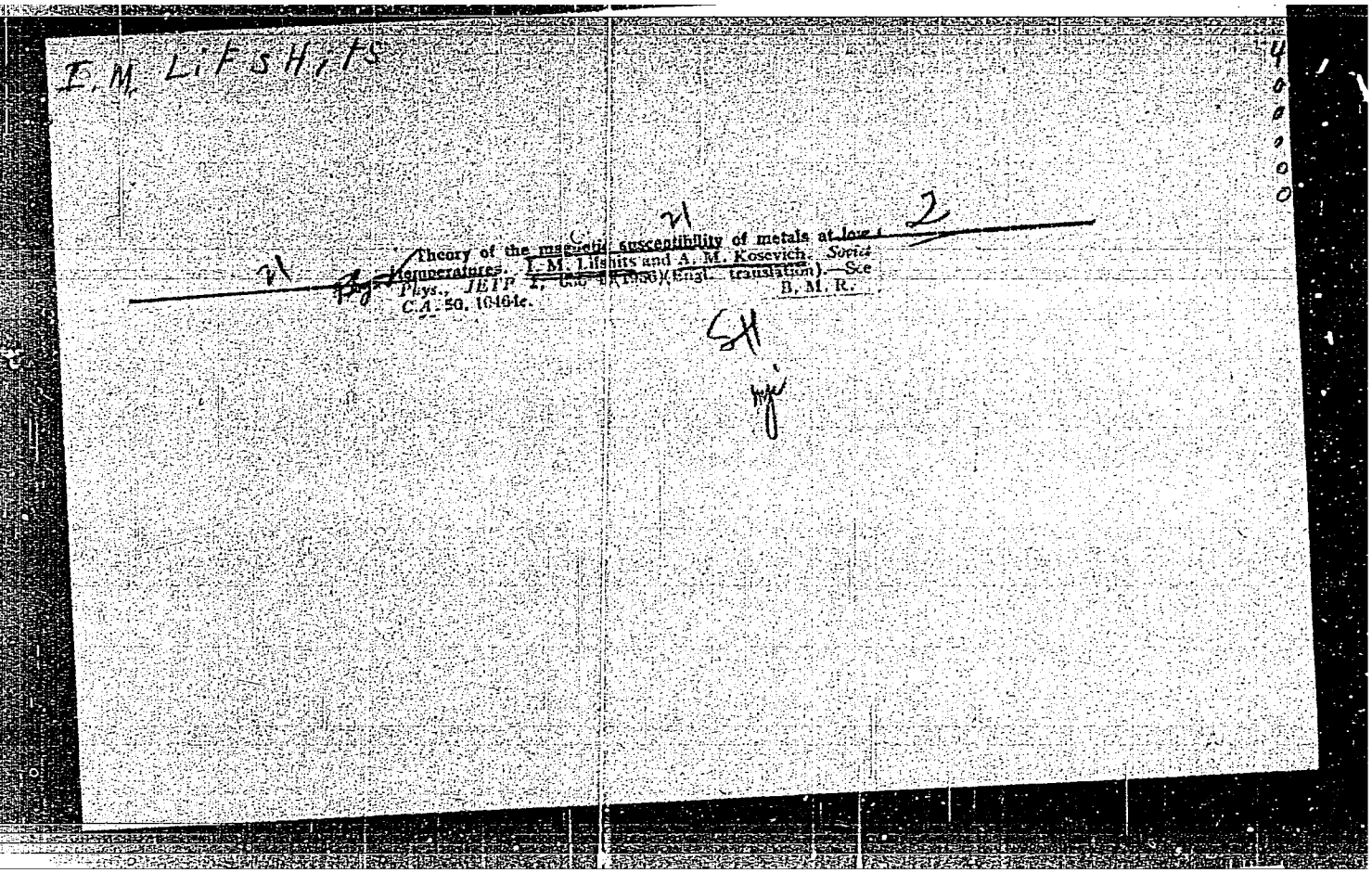
Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 1296

Author : Aleksandrov, B.N., Verkin, B.I., Lifshits, I.M., Stepanova, G.I.
Inst : Physical-Technical Inst. Academy of Sciences Ukrainian SSR
Title : Investigation of The Mechanism for Cleaning Metals of Admixtures Using the Zonal-Recrystallization Method

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 2, No 1, 105-119

Abstract : A detailed theoretical and experimental study is made (using alloys of the Pb-Sn[113] and Sn-Bi systems) of the mechanism for purifying metals by the zonal-recrystallization method. The impurity distribution was studied by measuring the activity of specimens, taken from various parts of the ingot, or by using the contrast-radiography or the residual-resistance methods. The role of the absence of equilibrium on the crystallization boundary and the role of diffusion and convective displacement in the zone are examined.

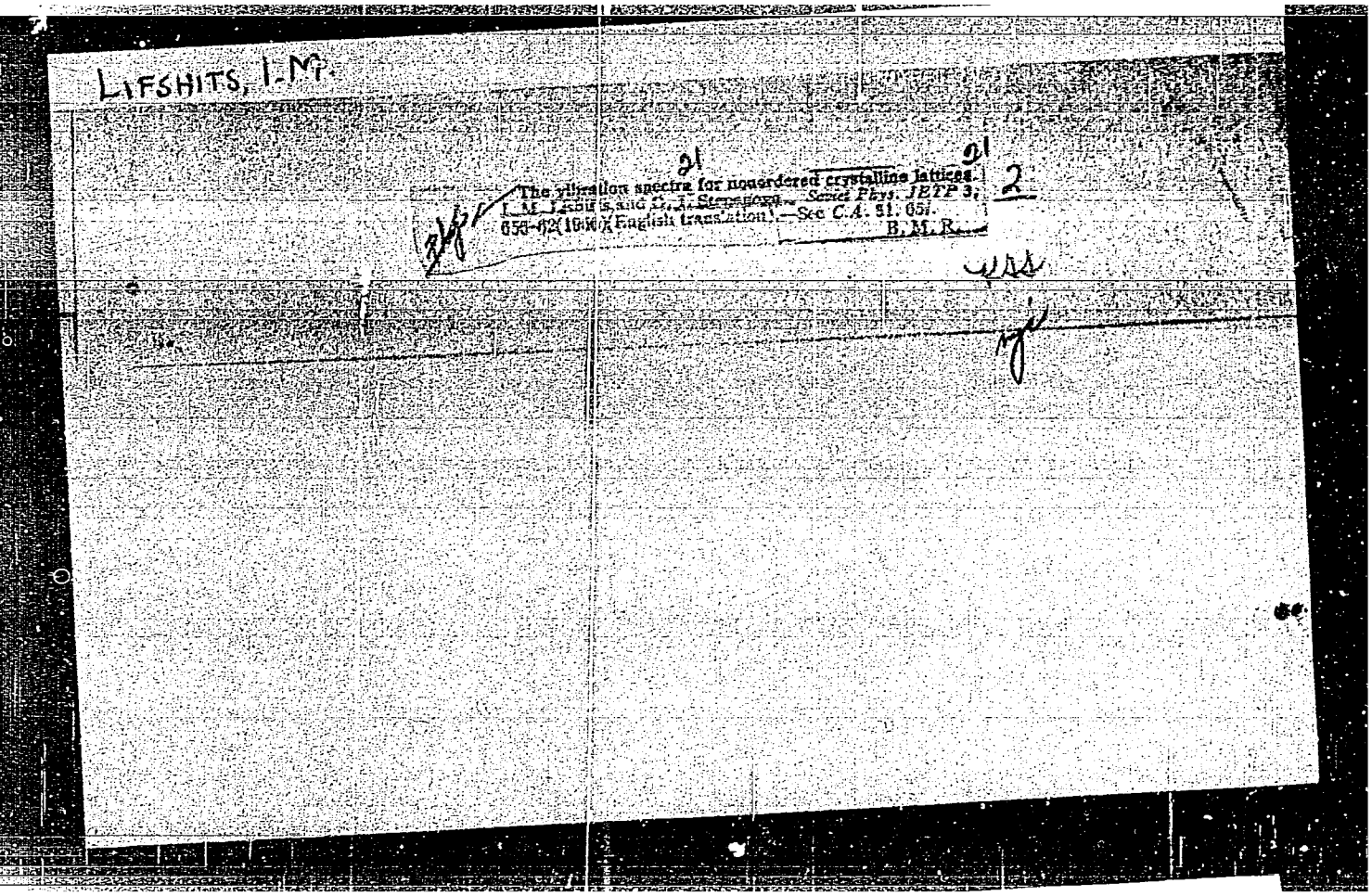
Card : 1/1



E. M. LIFSHITS

Theory of the magnetic susceptibility of metals at low temperatures. I. M. Lifshitz and A. M. Kosevich. *Soviet Phys., JETP* 2, [illegible] (1956) (Engl. translation).—See C.A. 50, 10464c.

B. M. R.



LIFSHITS, I. M.

21

The vibration spectra for disordered crystalline lattices. I. M. Lifshits, and G. I. Stepanov. *Soviet Phys. JETP* 3, 658-62 (1956) (English translation).—See *C.A.* 51, 651. B. M. R.

21 2

LIFSHITS, I.M.

537.312.8

3/4

6656 ON THE THEORY OF GALVANOMAGNETIC PHENOMENA IN METALS. I.M.Lifshits, M.Ya.Azbel' and M.I.Kaganov.

Phys

Zh. éksper. teor. Fiz., Vol. 30, No. 1, 220-2 (1956). In Russian.

It is shown that in the limit of very strong magnetic field strengths some elements of the conductivity tensor are independent of the scattering mechanism, and that in some cases it is possible in principle to deduce the topology of the Fermi surface from experimental data. J.M.Radcliffe

LIFSHITS, I. M.

G

USSR / Electricity.

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9735

Author : Lifshitz, I.M.

Inst : Physico-Technical Institute, Academy of Sciences Ukrainian SSR, Khar'kov

Title : Quantum Theory of Electric Conductivity of Metals in Magnetic Field

Orig P ub : Zh. eksperim. i teor. fiziki, 1956, 30, No 4, 814-816

Abstract : A consistent quantum th[illegible]y o[illegible] conductivity of metals in a magnetic field is constructed. No special assumptions are made concerning the form of the electron collision integral with phonons as well as the distortions of the crystalline lattice.

Card : 1/1

LIFSHITS, I.M.; STEPANOVA, G.I.

Oscillation spectrum of nonordered crystal lattices. Zhur.eksp. i teor. fiz. 30 no.5:938-946 My '56. (MIRA 9:9)

1.Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR.
(Crystal lattices)

LIFSHITS, I.M.; STEPANOVA, G.I.

Effect of ordered arrangements on the energy spectrum of phonons. Zhur. eksp. i teor. fiz. 31 no.1:156-157 Jl '56. (MLRA 9:11)

1. Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR.
(Isotopes--Spectra) (Crystal lattices)

LIFSHITZ, I.M.

CARD 1 / 2 PA - 1488

SUBJECT USSR / PHYSICS
AUTHOR AZBEL', M.JA., GERASIMENKO, V.I., LIFSIČ, I.M.
TITLE The Paramagnetic Resonance and the Polarization of Nuclei in Thick Layers of Metal.
PERIODICAL Žurn.eksp.i teor.fis, 31, fasc.2, 357-359 (1956)
Issued: 10 / 1956 reviewed: 11 / 1956

It is shown that with the help of a high frequency magnetic field $H_1 \gg (8\pi\delta_{eff}/c^2 Z T_{fw})H_o$ it is possible to polarize nuclei of rather great depth: $\delta_{eff} \sim 10^{-2}$ up to 1 cm (up to which the electron progresses on the occasion of diffusion during the time T_{fw}). Here H_o and H_1 denote the field strengths of the constant and high frequency magnetic field, T_{fw} - the time of the free length of path of an electron with spin exchange (?), Z - the surface impedance of the metal. For the development of a consequent theory the following MAXWELL'S equations: curl $\vec{E}=-(1/c)\partial\vec{B}/\partial t$, curl $H_1=(4\pi/c)\vec{j}$, $B=\vec{H}_1+4\pi\vec{M}$ and a kinetic equation for the operator $\hat{f}$ of electron density are to be solved. (The operator $\hat{f}$ acts only upon the spins).

$$\frac{\partial\hat{f}}{\partial t} + \frac{\partial\hat{f}}{\partial\vec{r}}\vec{v} + \frac{\partial\hat{f}}{\partial\vec{p}}\left\{e\vec{E} + \frac{e}{c}\left[\vec{v}\,\vec{H}\right]\right\} + \frac{i}{\hbar}\left[\mu\vec{H}\vec{\sigma},\hat{f}\right] + \left(\frac{\partial\hat{f}}{\partial t}\right)_{col} + \left(\frac{\partial\hat{f}}{\partial t}\right)_{fw} = 0$$

Here $(\partial\hat{f}/\partial t)_{col}$ and $(\partial\hat{f}/\partial t)_{sp}$ denote the collision integral with and without spin exchange respectively, $\vec{\sigma}$ - the spin operator, $\vec{v}$ and $\vec{p}$ - velocity and momentum of the electron. For these collision integrals explicit expressions are then given.

LIFSHITS, I.M.

CARD 1 / 2 PA - 1571

SUBJECT USSR / PHYSCIS
AUTHOR KAGANOV,M.I., LIFŠIC,I.M., TANATAROV,L.V.
TITLE Relaxation between Electrons and Lattice.
PERIODICAL Žurn.eksp.i teor.fis,31,fasc.2, 232-237 (1956)
Issued: 10 / 1956

Here the relaxation between the electrons of a metal and a crystal lattice (phonons) is studied. The method employed for this purpose permits the determination of the heat transfer coefficient for any temperatures.
At first the quantity of energy ($\bar{U}$) transferred by the electrons (per unit of volume) to the lattice in the course of one second is computed. The phonon function changes as a result of the "creation" and "annihilation" of phonons. Such processes are possible because the velocity of the electrons exceeds that of sound. To the creation of a phonon (seen from the point of view of quantum mechanics) there corresponds the ČERENKOV-like radiation of sound waves (in the classical sense). The expression found for $\bar{U}$ is explicitly written down and specialized for low and high temperatures. Furthermore, $\bar{U}$ is computed for the case that the difference of the temperatures Θ and T of the lattice and the electrons respectively is considerably less than T, and besides, for the case $T \ll \Theta$.
The expression for $\bar{U}$ for the case $T \gg T_0$, $\Theta - T \ll T$ (T_0 - DEBYE temperature) can be determined in a purely classical manner. For this purpose the radiation of sound waves by an electron is studied which moves with constant velocity v through the lattice. The equations of the enforced oscillations of the elastic

LIFSHITS, I.M.

CARD 1 / 2 PA - 1626

SUBJECT USSR / PHYSICS
AUTHOR LIFSIC, I.M.
TITLE On the Temperature-Dependent "Flash" in a Medium that is Exposed to the Action of Nuclear Radiation.

PERIODICAL Dokl.Akad.Nauk, 109, fasc.6, 1109-1111 (1956)
Issued: 12 / 1956

This "flashing up" is caused by a short but very intense heating in the neighborhood of every nuclear fission reaction. Here, only the mathematical side of the problem is investigated which, in its simplest form, may be formulated as follows: In a body which is bordered by the surface , sudden "chance" sources of heat develop during the process of irradiation at the points $\vec{r}_i, t_i$; these sources are distributed with equal probability n_o dV dt in any element of the fourdimensional volume d = dVdt. The temperature $T = T(\vec{r},t)$ is determined from the heat conductivity equation $\partial T/\partial t = \Delta T + \sum_I \delta(\vec{r}-\vec{r}_i)\delta(t-t_i)$; $T + \alpha(\partial T/\partial n)_\Omega = 0$; $T|_{t=0} = 0$. The mean temperature $\bar{T} = \bar{T}(\vec{r})$ is determined in the case of a steady process from the equation obtained by averaging the above equation over the probabilities and by the boundary transition $t \to 0$: $\Delta \bar{T} + n_o = 0$; $\bar{T} + \alpha(\partial \bar{T}/\partial n)|_\Omega = 0$. The density of the probability $P(\theta)$ remains to be determined for the case that at the given point it is true that $T - \bar{T} = \theta$. By the introduction of the GREEN'S function $g(\vec{r}, \vec{r}', t)$ of the

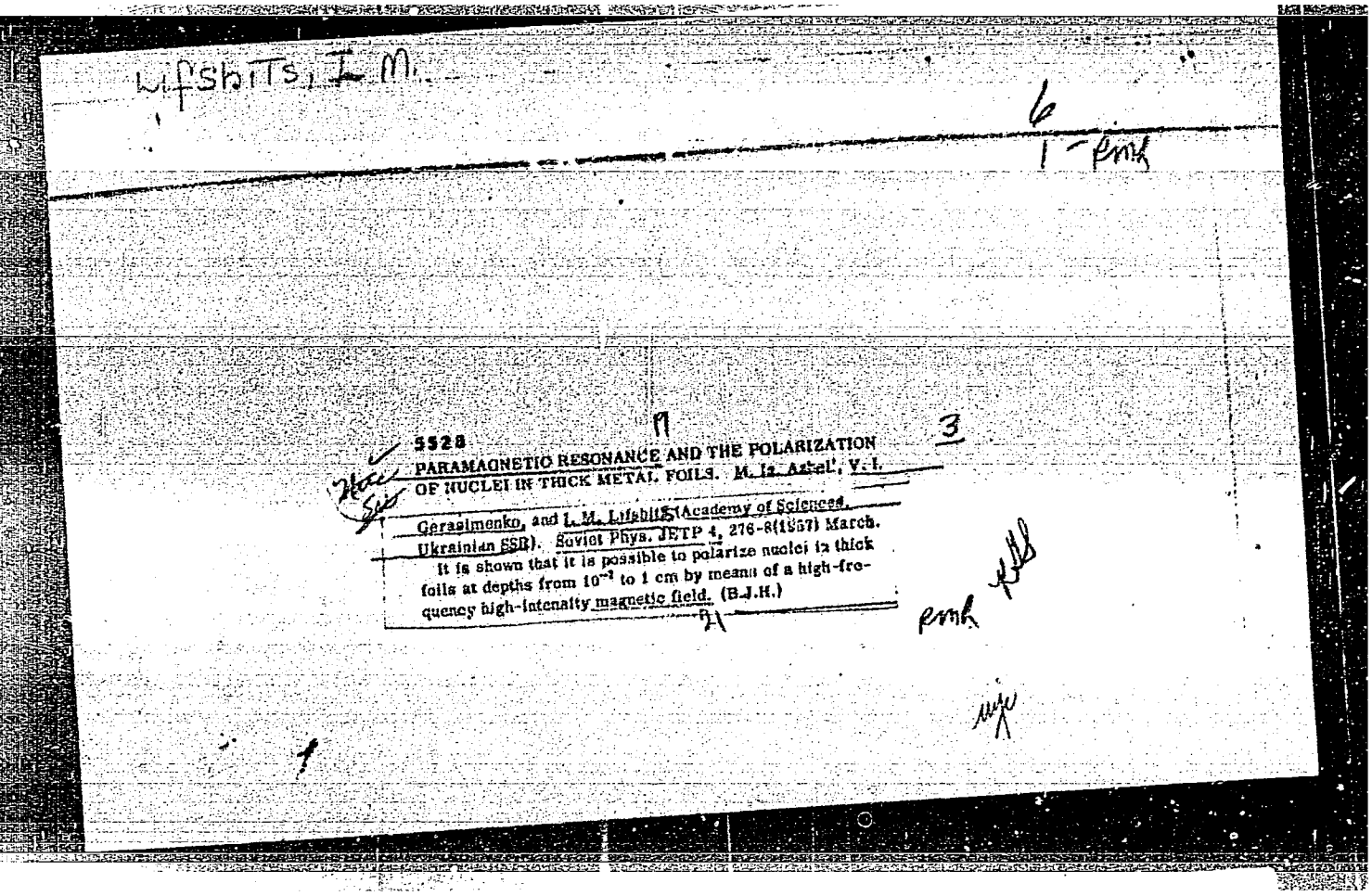
[illegible]: Physical-Technical Institute of the Academy of Science of the Ukrainian SSR

LIFSHITS, I. M., STEPANOVA, G. I.

"The Thermodynamics f of Solutions of Isotopes."

Problems Kinetics and Catalysis, v. 9, Isotopes in Catalysis, Moscow, Izd-vo AN SSSR, 1957, 442p.

Most of the papers in this collection were presented at the Conf. on Isotopes in Catalysis which took place in Moscow, Mar 31- Apr 5, 1956.



Lifshits, I. M.

6
1 - pmk

5528
PARAMAGNETIC RESONANCE AND THE POLARIZATION OF NUCLEI IN THICK METAL FOILS. M. Ia. Azbel', V. I. Gerasimenko, and I. M. Lifshits (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 276-8(1957) March.
It is shown that it is possible to polarize nuclei in thick foils at depths from 10^{-2} to 1 cm by means of a high-frequency high-intensity magnetic field. (B.J.H.)

3

pmk

LIVSHITS, I.M.; YURKSHTOVICH, N.A.

Improving the efficiency of the system for the approximate calculation of definite integrals from numerical quadrature formulas. Sbor. nauch. rab. Bel. politekh. inst. no.60:56-68 '57. (MIRA 13:2)

(Integrals)

LIFSHITS, I.M.; STEPANOVA, G.I.

Thermodynamics of isotope solutions. Probl. kin. i kat. 9:354-359 '57. (MIRA 11:3)
(Thermodynamics) (Solution (Chemistry)) (Isotopes)

LIFSHITS, I. M.

PA - 2847

AUTHOR: LIFSHITS, I.M., Corresponding Member of the Ukrainian Academy of Science.

TITLE: Some Problems of the Electron Theory of Metals. (Nekotory'ie problems elektronno' teorii metallov, Russian)

PERIODICAL: Vestnik Akademii Nauk SSSR, 1957, Vol 27, Nr 4, pp 46-53 (U.S.S.R.)
Received: 5 / 1957 Reviewed: 7 / 1957

ABSTRACT: Our knowledge of the most important mechanical, optical, electric, and magnetic properties of metals is based on the electron theory. All conceptions of the electron theory, as well as all its successes are closely connected with the ideas of quantum mechanics. The basic conception was that of the "free electrons". By means of BLOCH'S theory it was found that the energetic spectrum of the electron has a "zone-like" structure. However, BLOCH'S model is not quite satisfactory. The renewed raising of the problem of the electron theory of metals is closely connected with the attempt at avoiding all difficulties (arising on the occasion of the selection of various models for the purpose of determining the electron spectrum). This new attempt is based on the general conceptions of the possible types of the energetic spectrum of the quantum systems and on the knowledge of the quasiparticles by which this spectrum is realized. This new knowledge also makes it possible to develop a theory of paramagnetic resonance in metals.

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LIVSHITS, I. M.

PA - 2980

AUTHOR: KAGANOV,M.I., LIVSHITS,I.M., SINEL'NIKOV,K.D.

TITLE: On the Possibility of the Observation of the Modification of the Chemical Potential of Metal Electrons in the Magnetic Field. (O vozmoshnosti nabludeniya izmeneniya khimicheskogo potentsiala elektronov metalla v magnitnom pole, Russian)

PERIODICAL: Zhurnal Eksperim. i Teoret.Fiziki, 1957, Vol 32, Nr 3, pp 605-607 (U.S.S.R.)

Received: 6 / 1957 Reviewed: 7 / 1957

ABSTRACT: The order of magnitude of the potential difference caused by this effect between two samples of one and the same metal, the one of which is located in a strong magnetic field, is evaluated according to a formula from the work by I.M.LIVSHITS and A.M.KOSEVICH (Zhurnal Eksperim.i Teoret.Fiziki, 29, 730, 1955): in the case of $H=10^4$ G it amounts to about 10^{-6} V. The influence exercised by the mosaic structure of the crystal on the order of the effect is discussed. The modification of the chemical potential of the electron gas in the magnetic field leads to a dependence of the emission current (of cold as well as of thermoelectric emission) upon the magnetic field (ROSENTSVEIG, Zhurnal Eksperim. i Teoret. Fiziki 31, 520, 1956). The thermocurrent is given under special assumptions (magnetic field vertical to the surface of the metal, dispersion ~~knowledge also makes it possible to develop a theory of paramagnetic resonance in metals~~.

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LIFSHITS, I. M.

56-5-31/55

AUTHOR AZBEL', M.Ya., KAGANOV, M.I., LIFSHITS, I.M.

TITLE The Heat Conductance and the Thermoelectric Phenomena in Metals in a Magnetic Field.
(Teploprovodnost' i termoelektricheskiye yavleniya v metallakh v magnitnom pole - Russian)

PERIODICAL Zhurnal Eksperim.i Teoret.Fiziki,1957,Vol 32,Nr 5,pp 1188-1192 (U.S.S.R.)

ABSTRACT The paper under review determines asymptotic expressions for the tensors of the heat conductivity andfor the Thomson's coefficients in a strong magnetic field.In this context, no special assumptions with respect to the law of dispersions and to the shock integral are made.The quantization of the motion of the electron is not taken into account in this connection. The limits of the applicability of such a classical treatment are pointed out in a previously published paper refered to in the paper under review.In order to determine the kinetic coefficients, it is necessary to compute the current density j_i and the energy current w_i which appear under the influence of the electrical field E_i and of the temperature gradient $\partial T/\partial x_i$. Brief reference is made in the paper under review to the computation of j_i and of w_i. In orderto be able to express the experimentally measurable coefficients (resistance, heat conductivity,Thomson's coefficients) by the magnitudes $\sigma_{ik}^{(n)}$ and $s_{ik}^{(n)}$ as defined here, the law of preservation of energy for an electron gas is written down. The formulae obtained therefrom for the resistance,the tensor of the coefficients of the heat con-

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LIFSHITS, I.M.

56-3-37/59

AUTHORS: Azbel', M.Ya., Lifshits, I.M.

TITLE: On the Theory of the Paramagnetic Resonance of Electrons in Superconductors (K teorii elektronnogo paramagnitnogo rezonansa v sverkhprovodnikakh) (Letter to the Editor)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol. 33, Nr 3, (9), pp. 792 - 794 (USSR)

ABSTRACT: First, three previous papers dealing with the same subject are pointed out. Now the problem occurs whether a paramagnetic resonance and a selective transparency is possible in superconductors. As a diffusion of superconducting electrons does not take place, apparently only the normal electrons have to be investigated. Therefore, the difference of the behavior of a metal in the superconductive state is only connected with the fact that the constant magnetic field decreases with increasing depth. ($H = H_o e^{-z/\delta_o}$). Therefore the electron will polarize by the influence exercised by the constant magnetic field only during a time of $\delta_o/v \sim 10^{-13}$ sec, where v denotes the velocity of the electron. This time is now considerably shorter than the period of the highfrequency field, and thus the paramagnetic resonance

Card 1/2

SUBMITTED: June 13, 1957
AVAILABLE: Library of Congress

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LIFSHITS, I. M.

56-5-35/55

AUTHOR, TITLE: AZBEL', M.Ya., GERASIMENKO, V.I., LIFSHITS, I.M.
The Paramagnetic Resonance and the Polarization of Nuclei in Metals.
(Paramagnitnyy rezonans i polyarizatsiya yader v metallakh - Russian)

PERIODICAL: Zhurnal Eksperim.i Teoret.Fiziki, 1957, Vol 32, Nr 5, pp 1212-1225 (U.S.S.R.)

ABSTRACT: The Theory of the paramagnetic resonance, as constructed in the paper under review, is based on the simultaneous solution of the Maxwell's equations and of the kinetic equation for the density operator. The paper under review also determines the degree of polarization of the nuclei in a metal and the coefficient of transparency of metallic films, taking into account the diffusion of the spins. This problem is solved by means of the system of the Maxwell's equations $\mathrm{rot}\,\vec{E} = -(1/c)\,\partial\vec{B}/\partial t$; $\mathrm{rot}\,\vec{H} = (4\pi/c)\vec{j}$; $\vec{B} = \vec{H}_1 + 4\pi\vec{M}$, and of the kinetic equation for the operator of the electron density $(\partial f/\partial t) + \vec{v}(\partial f/\partial \vec{r}) + \partial f/\partial \vec{p}\left\{e\vec{E} + (e/c)\left[\vec{v}\vec{B}\right]\right\} + (i/\hbar)\left[\hat{\mathcal{H}}, f\right] + (\partial f/\partial t)_{st} = 0$; $\hat{\mathcal{H}} = \mu\hat{\sigma}\vec{B}$; $\vec{B} = \vec{B}_0 + \vec{B}_1(\vec{r}, t)$; $\vec{v} = \nabla_p \mathcal{E}(\vec{p})$. In this context, $\mathcal{E}$, $\vec{p}$ and $\vec{v}$ denote the energy, the quasiimpulse and the velocity of the electrons, respectively; $\hat{\sigma}$ stands for the operator of the spin, and $(\partial f/\partial t)_{st}$ for the shock integral of the electrons. For f also a boundary condition is given. By solving the kinetic equation one obtaines a connection between the current density $\vec{j}$, the electrical field strength $\vec{E}$, the magnitic spin moment $\vec{M}$, and

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The Paramagnetic Resonance and the Polarization of 56-5-35/55

LIFSHITS, I.M.

56-6-31/56

AUTHOR: LIFSHITS, I.M.,

TITLE: Quantum theory of Electrical Conductivity of Metals in a Magnetic Field. (Kvantovaya teoriya elektroprovodnosti metallov v magnitnom pole, Russian)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 32, Nr 6, pp 1509-1518 (U.S.S.R.)

ABSTRACT: Theoretically a quantum-mechanical theory for the conductivity of metals in a magnetic field is developed. The following individual derivations are carried out: the kinetic equation for the matrix of density, the asymptotic conditions of conductivity on strong magnetic fields, and the connection between the classical and the quantum-mechanical conductivity equation in the magnetic field. (With 4 Slavic References).

ASSOCIATION: Physical-Technical Institute of the Ukrainian Academy of Science

PRESENTED BY:

SUBMITTED: 22.11.1956

AVAILABLE: Library of Congress

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LIFSHITS, I. M.

56-2-25/47

AUTHORS: Lifshits, I. M., Stepanova, G. I.,

TITLE: A Note on the Correlation in Solid Solutions (Korrelyatsiya v tverdykh rastvorakh)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol. 33, Nr 2(8), pp. 485-494, (USSR)

ABSTRACT: The present paper develops a method for the description of non-equilibrium states of solid solutions with the specification of a system of correlation functions for the dissolved atoms, with the help of the method developed here the free energy of the solution in the state of "particulary equilibrium" can be computed. At the outset a formula is given for the free energy corresponding to equilibrium state. The free energy of a solid solution is a functional of the interaction of two, three... admixture electrons. The free energy can also be represented as a functional of pair interactions and polarization corrections of third, forth..etc order. From the expression obtained in this way for the free energy the chemical potentials of the solvent and the dissolved substance can be derived without difficulty. The next chapter deals with non-equilibrium states of solid solutions, at the same time the free energy, the entropy and the correlation functions are computed. The authors determine as an example an explicite expression for the non equilibrium free energy, if the nonequilibrium state results from tempering of the solution. The existence of a corre-

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LIFSHITS, I. M. 56-7-14/66

AUTHOR LIFSHITS, I.M., KOSEVICH, A.M.

TITLE On the Theory of the SHUBNIKOV-DE HAAS-Effect. (K teorii effekta Shubnikova-De Gaaza.- Russian)

PERIODICAL Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 33, Nr 7, pp 88 - 100 (USSR).

ABSTRACT By the application of the general formulae by I. LIFSHITS, Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 32, p 1500 the present paper investigates the quantum-like oscillations of the tensors of the electrical conductivity $\sigma^{\alpha\beta}$ and of the specific resistance. First the formulae for the quantum-like oscillations of the conductivity tensor are written down. Because of the structure of the integrals contained therein the oscillating factors which are of interest here can easily be separated and therefore the oscillations $\Delta\sigma^{\alpha\beta}$ can easily be expressed by the oscillations of the magnetic momentum and by the value of the classical tensor of mobility.

The oscillations of the conductivity: At first the contribution of a group of electrons with assummed dispersion law to the oscillating part of the electrical conductivity if investigated. Next, the authors change over to new variables. Each group of electrons furnishes its contribution to

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CARD 2/2 On the Theory of the SHUBNIKOV-DE HAAS-Effect. 56-7-14/66

$\Delta\sigma^{\alpha\beta}$. The contribution of each zone is connected with ΔM^z only at a corresponding electron group. Also some remarks are made concerning the amplitudes of the oscillations $\Delta\sigma^{\alpha\beta}$.

The asymptotics of the oscillations of the conductivity in strong magnetic fields. In this case amplitudes can be developed asymptotically in a power series. The asymptotic is here written down also for the special case that FERMI'S boundary surface disintegrates into some closed surfaces. The oscillations of the resistance: When experiments are carried out, not the tensor of the electrical conductivity $\sigma^{\alpha\beta}$ but the tensor of the specific resistance is measured. Therefore the oscillatory share of $\varrho^{\alpha\beta}$ has to be determined. The connection between $\sigma^{\alpha\beta}$ and $\varrho^{\alpha\beta}$ is given here. The expression for $\Delta\varrho^{\alpha\beta}$ contains classical values and oscillatory shares. In conclusion the oscillations for some concrete cases are computed (one zone of conductivity and two zones with $N^+ = N^-$). (No Illustrations)

ASSOCIATION: Physical-Technical Institute of the Academy of Sciences of the Ukrainian S.S.R. (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR.)

SUBMITTED: 22.11.1956
AVAILABLE: Library of Congress.

LIFSHITS, I.M.

56-4-18/54

AUTHORS: Yesel'son, B.N., Kaganov, M.I., Lifshits, I.M.

TITLE: The Thermodynamics of the Phase Transition between He I and He II in Solutions of Helium Isotopes (Termodinamika fazovogo perekhoda He I - He II v rastvorakh izotopov geliya)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol. 33, Nr 4, pp. 936 - 944 (USSR)

ABSTRACT: 1.) The phenomena that are connected with the transition from He I and He II in solutions of helium isotopes are thermodynamically (theoretically) treated. It is shown that this transition, in the range from 1,35 to 3,0°K, is a second type phase transition.
2.) It is shown that at the temperature of the second type phase transition a point of sudden irregularity should occur in the derivative as well of the partial as of the total pressure according to the temperature, which fact is experimentally confirmed.
3.) It is shown that at T_λ in dependence on the distribution coefficient, a point of sudden irregularity should be observed in the derivative according to the temperature.
4.)It is shown that at T_λ a point of sudden irregularity

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LIFSHITS, I.M.

26-58-5-3/57

AUTHOR: Lifshits, I.M., Professor, Corresponding Member of the Ukrainian SSR Academy of Sciences

TITLE: Quasi-Particles in Modern Physics (Kvazichastitsy v sovremennoy fizike)

PERIODICAL: Priroda, 1958, Nr 5, pp 11-20 (USSR)

ABSTRACT: The dual nature of matter, corpuscular and undulatory, is explained and a definition of particles is given: particles can be considered as elementary excitations of quantum fields; they are structural units of substance and at the same time structural units of motion. In contrast to ordinary particles, quasi-particles are carriers or elementary excitations and motion, without being structural units of a medium in which they occur. They can exist only within some medium or "background" and cannot arise in a vacuum. The law of dispersion for quasi-particles is presented and its distinction from that of ordinary particles is explained. As examples of quasi-particles, some of their types are mentioned and their brief characteristics are given. Among them are: 1) phonons, structural units of motion of a

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crystalline lattice, i.e. individual waves which are carriers of elementary portions of energy and momentum; 2) Excitons, elementary portions of electronic excitations in crystals, whose existence was first noticed by Ya.I. Frenkel'; 3) Spin waves or ferromagnons, introduced by F. Blokh, elementary excitations in ferromagnetics; 4) Elementary excitations in superfluidity of a liquid (HeII), which was discovered by P.L. Kapitsa and explained first by L.D. Landau; 5) Conductivity electrons in metals, possessing a peculiar dispersion law different from that of ordinary electrons. In addition to these types of quasi-particles, the author mentions polarons, or polaron excitations in semiconductors introduced by L.D. Landau and S.I. Pekar, without dwelling on their characteristics.
There are 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut UkrSSR Akademii nauk (Physico-Technical Institute of the Ukrainian Academy of Sciences), Khar'kov

AVAILABLE: Library of Congress

 1. Particles-Theory 2. Physics-Quasi-particles

SOV/126-6-1-22/33

AUTHORS: Aleksandrov, B. N., Verkin, B. I., Lifshits, I. M. and Stepanova, G. I.

TITLE: On the Possible Causes of the Non-uniform Distribution of Admixtures in a Crystallising Casting (K voprosu o vozmozhnykh prichinakh neodnorodnogo raspredeleniya primesey v kristallizuyemom slitke)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 1, pp 167-168 (USSR)

ABSTRACT: In a paper published in 1956 by the authors (Ref.1) the mechanism was investigated of purification of metals from admixtures by means of zonal recrystallisation. There it was assumed that in front of the crystallisation front the conditions are such that solidification of the melt does not take place; in this paper the possible consequences are mathematically analysed of the non-validity of this assumption. Numerical evaluation for the system lead-tin (about 1% tin) indicates that for this system a periodic "blocking up" of admixtures in the solid phase can be anticipated. Indeed, exposures obtained by contact radiography of Pb-Sn^{119} castings showed a large number of transverse bands corresponding

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SOV/126-6-1-22/33

On the Possible Causes of the Non-uniform Distribution of Admixtures in a Crystallising Casting

to excess Sn admixture in these spots (Ref.1).
There is one Soviet reference.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN Ukr. SSR
(Institute for Physics and Technology, Ac.Sc. Ukr.SSR)

SUBMITTED: January 7, 1957

Card 2/2

1. Metals--Purification 2. Metals--Crystallization
3. Mathematics--Applications

24 (6)
AUTHORS: Lifshits, I. M., Slezov, V. V. SOV/56-35-2-24/60

TITLE: On the Kinetics of the Diffusion Decay of Supersaturated Solid Solutions (O kinetike diffuzionnogo raspada peresyshchennykh tverdykh rastvorov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 2, pp 479-492 (USSR)

ABSTRACT: The forming of a new phase by means of a diffusion process can be divided into two stages: The formation of seeds and the development of seeds to grains of the new phase; coalescence of grains. In the present paper the authors investigate the kinetics of the growth of seeds at the beginning of coalescence as well as the coalescence process itself, taking account of the results obtained by other authors (Refs 1 - 4), especially those obtained by Todes (Ref 1). In the first chapter the problem itself is discussed as such, the second chapter deals with the asymptotic modification of critical dimensions, and in the third chapter the asymptotic distribution function $\varphi(u,\tau)$ is derived and discussed. As an example for the application of the theory developed and of the asymptotic functions, the mechanism of

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On the Kinetics of the Diffusion Decay of Supersaturated Solid Solutions

SOV/56-35-2-24/60

the sintering process is dealt with in the fourth chapter. An appendix deals with the determination of the distribution function at $u > u_o$ in the neighborhood of the u_o-point.

There are 6 figures and 4 references, 4 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute, AS Ukrainskaya SSR), Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)

SUBMITTED: March 24, 1958

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SOV/56-35-3-20/61

24(3)

AUTHORS: Azbel', M. Ya., Gerasimenko, V. I., Lifshits, I. M.

TITLE: On the Theory of Paramagnetic Resonance in Metals (K teorii paramagnitnogo rezonansa v metallakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 3, pp 691-702 (USSR)

ABSTRACT: Paramagnetic resonance may occur if a metal is located in a steady magnetic field H_0 and in a variable electromagnetic field H_1, in which case the following must apply to the frequency of the variable field: $\omega = \Omega_0 \equiv 2\mu H_0/\hbar$. The absorption of the energy of the electromagnetic waves impinging upon the metal under the conditions of paramagnetic resonance has already been investigated by a number of experiments (e.g. Ref 2). The first theoretical investigation of this problem together with the calculation of electron diffusion from the surface layer was carried out by Dyson (Dayson) (Ref 3). The authors of the present paper developed a general theory of paramagnetic resonance in an earlier paper (Ref 1); it is based upon the

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solution of the equation for the electron density operator. The electrons are looked upon as a gas of noninteracting quasiparticles; for $\varepsilon(\vec{p})$ any dispersion law applies, and also the direction of H_0 and the intensity of H_1 may be chosen at random. In the present paper the authors, basing upon the results obtained by the preceding paper (Ref 1), investigate the dependence of surface impedance on the angle of inclination of the steady magnetic field to the metal surface, and further also the influence exercised by the dispersion law on impedance, and the case of sufficiently strong variable fields (resonance saturation). The following cases are dealt with: 1) In the interval $\Delta\varepsilon$ there are no open surfaces; 2) in $\Delta\varepsilon$ there are open and closed isoenergetic surfaces ($\varepsilon(\vec{p}) = \varepsilon$), and 3) in $\Delta\varepsilon$ there are only closed isoenergetic surfaces. Calculations are at first carried out for $\delta \ll \delta_{eff}$ (δ = skin depth, δ_{eff} = depth of electron diffusion); $\delta \gtrsim \delta_{eff}$ (range of normal skin effect, $j = \sigma E$) is dealt with in an appendix. It is found that in strong H_0-fields surface impedance depends essentially on the angle of inclination between the H_0-direction and the metal surface.

On the Theory of Paramagnetic Resonance in Metals SOV/56-35-3-20/61

There are 1 figure and 7 references, 5 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED: March 29, 1958

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5(4)
AUTHORS: Lifshits, I. M., Sanikidze, D. G. SOV/56-35-4-3...

TITLE: The Pomeranchuk-Effect and the State Diagram of He^3-He^4-Solutions (Effekt Pomeranchuka i diagramma sostoyaniya rastvorov He^3-He^4)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 4, pp 1020 - 1025 (USSR)

ABSTRACT: The equilibrium diagram for the solid and liquid phase of He^3-He^4-solutions has interesting characteristic features which are connected with the Pomeranchuk-effect. Pomeranchuk showed that the He^3-melting curve in the P-T-diagram has a minimum and that lower points have a negative melting heat (Refs 1,2). This effect was observed in the course of experiments by Walters and Fairbank (Uolters, Ferbank) (Ref 3). From the experimental data on the entropy of He^3 it follows for the minimum that: $P_c \approx$ 30 atm, $T_0 \approx 0.5^\circ K$. In the present paper the authors investigate the influence of the Pomeranchuk-effect on the

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equilibrium of the liquid and solid phases in He^3-He^4-solutions. First, the phase equilibrium in weak solutions of He^4 in He^3 is investigated. Formulation of equilibrium conditions is according to Landau and Lifshits (Ref 4); three important cases are investigated: 1) $\Delta P=0$: with $P=P_c$ the equilibrium curves for low concentration have a parabolic shape which is touched by the T-axis (in $T=T_0$)(Fig 1). 2) $\Delta P< 0$: The equilibrium curves in the domain of low concentration are parabolas which touch neither one another nor the T-axis. 3) $\Delta P > 0$: The curves are again parabolas which, however, intersect in T_1 and T_2 and which also intersect the T-axis in these points. This case is discussed more in detail. For all three cases equations are given for x' and x" (He^4-concentrations in the liquid and solid phase respectively). The next chapter deals with the model of the "impurity-containing gas". The energy spectrum of the liquid He^3, which contains He^4-traces, is investigated.

The Pomeranchuk-Effect and the State Diagram of He^3-He^4- SOV/56-36-4-33/5
Solutions

The interaction between He^3-, and He^4-atoms leads to the formation of additional energy levels in the solution. The energy distribution of the impurity-atoms obeys the Boltzmann (Bol'tsman) statistics up to a certain temperature (degeneration of the gas containing impurities). The conditions for which deviations from classical statistics occur were investigated by Pomeranchuk (Ref 5). For spectra of the type $\varepsilon = \varepsilon_0 + p^2/2\mu$ and $\varepsilon = \varepsilon_0 + (p-p_0)^2/2\mu$ formulae are given for the free energy of weak solutions of perfect gases, for the entropy and the degeneration temperature of a Bose (Bose) gas. Also the concentration ratios in the phases are investigated. In the last chapter of this paper the authors discuss highly concentrated solutions . At $T < 0.83^\circ K$ liquid He^3-He^4-mixtures separate into two phases of different He^3-concentration. Figure 4 shows such an equilibrium diagram for $P > P_o$. The variation dT/dP is estimated at:

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The Pomeranchuk-Effect and the State Diagram of He^3-He^4- SOV/56-34-4-55/52
Solutions

$(dT/dP)_{x'=0.07} \sim 10^{-2}$ degrees/atm (Ref 12). There are 4 figures and 12 references, 7 of which are Soviet.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)

SUBMITTED: May 26, 1958

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24(3), 24(5) SOV/56-35-5-28/56

AUTHORS: Lifshits, I. M., Peschanskiy, V. G.

TITLE: Galvanomagnetic Characteristics of Metals With Open Fermi Surfaces. I (Gal'vanomagnitnyye kharakteristiki metallov s otkrytymi poverkhnostyami Fermi. I)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 5, pp 1251-1264 (USSR)

ABSTRACT: Lifshits, Azbel' and Kaganov (Ref 1) developed a theory of galvanomagnetic phenomena in metals for the case of any dispersion law $\varepsilon = \varepsilon(\vec{p})$ and any form of collision integral on the basis of the experimental determination of the galvanomagnetic characteristic of metals. If the Fermi surface itself is open, or if in its vicinity there is an open isoenergetic surface, the asymptotic course of the conductivity tensor σ_{ik} differs considerably from the asymptotic course for the case that the isoenergetic surface is closed. This is further explained for the case of the Hall (Kholl) constant. In the present paper the galvanomagnetic characteristics of metals are investigated under the influence of strong magnetic fields and for various types

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Galvanomagnetic Characteristics of Metals With Open Fermi Surfaces. I

of open isoenergetic surfaces and the characteristics of the angular dependence of these quantities is discussed. All considerations are based on the assumption of the existence of strong magnetic fields. The angular dependence of the galvanomagnetic parameters on field direction are subjected to a very detailed investigation, and their relation to the topology of an open surface is explained. A detailed analysis of the possibility of a saturation of resistance for certain orientations of the magnetic field with respect to the crystal axes and the quadratic increase of resistance with H in the case of other orientations is dealt with (cf. Ref 1). The conditions are investigated at which resistance varies linearly with the field. This is done by forming mean values over the orientations of the crystallites in polycrystalline samples. In conclusion, the authors thank M. I. Kaganov for discussions. There are 7 figures and 4 references, 3 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR) Khar'kovskiy gosudarstvennyy universitet

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SOV/181-1-9-14/31

24(6), 18(0)

AUTHORS: Lifshits, I. M., Slezov, V. V.

TITLE: On the Theory of Coalescence of Solid Solutions

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 9, pp 1401 - 1410 (USSR)

ABSTRACT: The authors investigated the influence exerted by various factors (such as elastic stress, grain anisotropy, "collisions" between grains et al) on the decomposition of an oversaturated solid solution by diffusion. By way of introduction, the authors briefly effect the division of the decomposition by diffusion into two stages, and discuss the principles of its description by means of the coalescence theory that had been already developed in a previous investigation (Ref 1). The system of equations describing the decomposition by diffusion consists of the equation of continuity, the theorem of conservation of matter, and an equation describing the velocity of the diffusion-bound grain growth. Part 1 of the present paper investigates the influence exerted by the "collisions" of grains. Such "collisions" mean the same as immediate coalescence as well as diffusion-bound interaction of the grains, with intervals smaller than the grain dimensions. As is shown,

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On the Theory of Coalescence of Solid Solutions SOV/181-1-9-14/31

their consideration leads only to irrelevant changes in the distribution function. Part 2 investigates the influence of the elastic stresses occurring in the grain growth. It is shown that their consideration leads solely to a change in some numerical coefficients and factors in the final formulas. Part 3 briefly investigates the influence of anisotropy of the grain and the solution, and part 4 offers a discussion of the influence exerted by heterodiffusion processes in ordered solid solutions. Such processes are meant herein, in which the grain growth is influenced by independent diffusion. To clarify the conditions, the pore growth is observed in a strongly ordered alloy or an NaCl type ion crystal which is oversaturated with vacancies. As is shown, the consideration of these effects leads to a change in various numerical coefficients in the distribution function. Part 5, finally, derives an accurate solution for a given distribution function (under certain restricting conditions). There are 1 figure and 3 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut Khar'kov (Institute of Physics and Technology, Khar'kov)

LIFTSHITS, I. M.

5(0) PHASE I BOOK EXPLOITATION SOV/2019

Kazan. Khimiko-tekhnologicheskiy institut imeni S.M. Kirova

Trudy, vyp. 22, Khimicheskiye nauki (Transactions of the Chemical and Technological Institute imeni S.M. Kirov, Kazan. Nr 22, Chemical Sciences) Kazan', 1958. 173 p. Errata slip inserted. 300 copies printed.

Editorial Board: K.N. Mochalov (Resp. Ed.) Professor, A.A. Trafanov, (Resp. Ed.) Professor, I. Ye. Moysak (Deputy Resp. Ed.) Professor, G.S. Vozdvizhenskiy, Professor, A. Ye. Arbuzov, Academician, Kh. M. Mushtari, Professor, S.M. Kochergin, Professor, A.M. Grigor'yev, Professor, N.A. Kholevo, Professor, Dzh. A. Tarzimanov (Resp. Secretary) Docent; Ed.: Yu. Karev; Tech. Ed.: I. Kh. Zayumllin.

PURPOSE: This book is intended for industrial chemists, technologists, scientists, teachers, and research students in applied chemistry.

COVERAGE: The collection contains reports by faculty members of the sponsoring institute and also commemorates the 75th year of the birth and first anniversary of the death of Professor Aleksey Mikhaylovich Vasil'yev, Doctor of Chemical Sciences and Head of the Faculty. A review of Vasil'yev's scientific activities is given along with a chronological bibliography of his published works and that of members of the institute under his leadership. Articles of the collection deal mainly with electro-chemistry and the analysis of electrochemical processes, chemical analyses, and investigations of the prospective application of physiochemical phenomena in industrial processes, e.g., cleansing with ultrasound, enhancing the properties of building materials with additives, etc. References are given at the end of each article.

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LIFSHITS, I.M.

24(0) SOV/30-59-2-42/60

AUTHOR: Khalatnikov, I. M., Doctor of Physical and Mathematical Sciences

TITLE: Investigations of Low-temperature Physics (Issledovaniya po fizike nizkikh temperatur)

PERIODICAL: Vestnik Akademii nauk SSSR, 1959, Nr 2, pp 98-100 (USSR)

ABSTRACT: The 5th All-Union Conference on this problem took place in Tbilisi from October 27 to November 1, 1958. It was attended by physicists from Moscow, Khar'kov, Leningrad, Tbilisi, Sverdlovsk, and Kiyev. 4 fields of low-temperature physics were discussed: superliquidity of liquid helium II, supraconductivity, antiferromagnetism, magneto-resistive effect. The following reports and communications were heard: A. A. Abrikosov, L. P. Gor'kov reported on the investigation of the properties of supraconductive alloys. A. A. Abrikosov, L. P. Gor'kov, I. M. Khalatnikov spoke of properties of supraconductors in the high-frequency magnetic field. D. V. Shirkov and Chen' Chun'-yan' and Chzhou Si-shin', two young Chinese scientists working at Moscow University, described investigations for determination of the influence exercised by the Coulomb (Kulon) interaction of charges on supraconductivity. V. V. Tolmachev explained the

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nature of the so-called collective excitations of the Bose type in supraconductors. D. N. Zubarev, Yu. A. Tserkovnikov spoke of the thermodynamics of supraconductors and B. T. Geylikman, V. Z. Kresin of the thermal conduction of supraconductors. Yu. V. Sharvin, V. F. Gantmakher reported on experimental work with supraconductors. N. V. Zavaritskiy spoke of the measurement of the anisotropy of thermal conductivity in the supraconductive state. In a series of reports problems of the superliquidity of helium were discussed, which was discovered in 1938 by P. L. Kapitsa and the theory of which was set up in 1941 by L. D. Landau. E. L. Andronikashvili and his collaborators investigated the properties of rotating helium. V. P. Pe[illegible]kov spoke of the effect of the formation of the boundary between superliquid and non superliquid helium. Guan Vey-yan', collaborator of the Institut fizicheskikh problem (Institute of Physical Problems) investigated the properties of the so-called jump in temperature of Kapitsa. I. M. Lifshits, V. D. Peschanskiy investigated galvanomagnetic phenomena in strong magnetic fields for metals with open Fermi surfaces. N. Ye. Alekseyevskiy, Yu. P. Gaydukov experimentally investigated the re[illegible]ance anisotropy of gold monocrystals in the magnetic fie[illegible]. L. S. Kan, B. G. Lazarev combine the presence of a temperature minimum with the structural state of the metal. M. Ya. Azbel' reported on the quantum theory of metallic conductivity in the alternating electromagnetic and constant magnetic field. A. S. Borovik-Romanov reported on the weak ferromagnetism in antiferromagnetic samples of $MnCO_3$. N. M. Kreynes,

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Ye. A. Turov investigated the magnetic anisotropy of the antiferromagnetic monocrystals $CuSO_4$ and $CoSO_4$. R. A. Alikhanov reported on neutronographic investigations of antiferromagnetics. Ya. I. Kondorskiy and collaborators reported on the susceptibility of nickel and nickel-copper alloys at low temperatures. M. I. Kaganov, V. M. Tsukernik reported on kinetic phenomena in ferromagnetics at low temperatures. A. I. Akhiyezer, V. G. Bar'yakhtar, and S. P. Peletminskiy spoke of computations of the relaxation of the magnetic moment in ferromagnetic dielectrics at low temperatures. T. I. Sanadze spoke of observation results of paramagnetic resonance of terbium in the $TbNO_3 \cdot 6H_2O$ nitrate. G. R. Khutsishvili gave a theoretical analysis of the orientation of the nuclear spin in the Overhauser (Overkhauzer) effect in nonmetals. B. N. Samoylov, N. N. Reynov and collaborators reported on obtaining orientated nuclei. R. F. Bulatova, V. S. Kogan and B. G. Lazarev showed that hydrogen isotopes in solid state have different structures. I. A. Gindin, B. G. Lazarev, Kh. D. Starodubov and V. I. Khotkevich detected polymorphism in a number of metals at low temperatures. E. L. Andronikashvili, V. P. Peshkov and M. P. Malkov reported on the stage of development of foreign scientific research work in the field of low-temperature physics. At the end of the Conference P. L. Kapitsa spoke of his successful development of investigations in the field of low-temperature physics. The participants of the Conference visited the Institut fiziki Akademii nauk Gruzinskoy SSR (Physics Institute of the Academy of Sciences of the Gruzinskaya SSR) and the Physics Faculty of Tbilisi University as well as the building of the new research atomic reactor near Tbilisi.

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SOV/70-4-5-31/36

AUTHORS: Lifshits, I. M., Chernov, A. A.

TITLE: Macroscopic Steps on Crystal Surfaces

PERIODICAL: Kristallografiya, 1959, Vol 4, Nr 5, pp 788-791 (USSR)

ABSTRACT: The formation of macroscopic steps on crystal surfaces, whose free surface energy tends to a minimum, and the kinetics related to the stable form of steps on the faces of crystals, being grown of a gas phase or evaporated, are discussed in two dimensions. If a row with the shortest interatomic distances is X of orthogonal coordinates, a bent surface $y(x)$ has the minimum free energy when

$$\int (F(p) + \lambda y)\, dx = \min, \quad F(p) \equiv \alpha(p)\ \sqrt{1 + p^2}.$$

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where $\alpha(p)$ is the unit free surface energy; $p \equiv y'x \equiv \tan\varphi$; Λ is Lagrange multiplier; and φ is compliment to kink angle. Adding a few minute particles or nucleus, δN, at the kink, $x_c y_c$, the bent surface can be altered and derivatives p_+ and p_- obtained, since the added chemical potential

$$[F'_p]_{x_c} \frac{\delta y_c}{\delta N} + [F - pF'_p]_{x_c} \frac{\delta x_c}{\delta N}.$$

is a finite quantity only when

$$[F'_p]_{x_c} \equiv (F'_p)_{p=p_+} - (F'_p)_{p=p_-} = 0,$$
$$[F - pF'_p]_{x_c} \equiv (F - pF'_p)_{p=p_+} - (F - pF'_p)_{p=p_-} = 0.$$

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Considering a number of special cases, 7 additional equations are derived which are applicable in certain cases. For instance, a stable step form develops at the crystal growth of a gas phase when

$$\frac{d}{ds}\left(D\frac{dn}{ds}\right) - \gamma(n - n_r) - \beta(n - n_k) = 0.$$

where s is the circumference of a step; n is the density of absorbed particles; n_k, n_r, $n_{(s)}$ are same in the crystal, gas phase, and at the step, respectively; D is the diffusion factor at the surface; γ is the same between the gas phase and the crystal surface; and β is the rate at which adsorbed particles turn into the solid phase. A step moves at the rate of V, defined by

$$r_0\beta(n - n_k) = V\sin\varphi.$$

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21(8), 18(7) SOV/89-6-4-3/27

AUTHORS: Lifshits, I. M., Kaganov, M. I., Tanatarov, L. V.

TITLE: On the Theory of the Radiation Induced Changes in Metals (K teorii radiatsionnykh izmeneniy v metallakh)

PERIODICAL: Atomnaya energiya, 1959, Vol 6, Nr 4, pp 391-402 (USSR)

ABSTRACT: Temperature fluctuation and the phenomena connected therewith are theoretically investigated in fissile material. Fluctuation is given by the quantity of energy liberated at every decay. The occurrence of similar non-thermodynamic fluctuations leads to a variation of the temperature-dependent characteristics of the irradiated medium. Here the case arises that during irradiation the kinetic coefficients (electric conductivity, diffusion, thermal reaction rate) do not correspond to the mean temperature of the medium determined from the total quantity of heat. The particles passing through matter thus cause local heating. The equations describing these processes are derived, in which connection the interaction between electrons and lattice was taken into account because it leads to the establishment of temperature equilibrium. Furthermore, a method is developed for the purpose of calculating the effective kinetic coefficients of the fissile material.

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On the Theory of the Radiation Induced Changes in Metals

In conclusion, it is explained in what way the mechanical properties of fissile substances vary as a result of local heating. In addition, the two following calculations are described: a) Calculating the average of a physical quantity $F(T_e, T_j)$ depending on 2 temperatures (T_e - electron temperature, T_j - lattice temperature). b) Evaluation of this calculation for high temperatures, in which case the equation no longer remains linear when calculating thermal conductivity and can therefore not be solved. If, however, the specific heat c and the thermal conductivity $\varkappa$ depend on temperature according to an exponential law, it is easier to determine the average. The equations and their solutions are given for several needle-shaped, an infinitely long and a punctiform source. (The solutions of an equivalent problem are by Ya. B. Zel'dovich and A. S. Kompaneyets). The most important results obtained by this paper have already been published in 1951-1952 in the reports of the FTI of the AN USSR (AS UkrSSR). There are 2 figures and 12 references, 9 of which are Soviet.

SUBMITTED: September 17, 1958

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L. i-fshits, I. M.

24(8)
AUTHORS: Yessel'son, B. N., Kaganov, M. I., Lifshits, I. M. SOV/56-36-3-69/71

TITLE: Reply to the Letter by M. P. Mokhnatkin (Otvet na pis'mo M. P. Mokhnatkina)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 3, p 964 (USSR)

ABSTRACT: In a "Letter to the Editor", Mokhnatkin criticized a paper by the authors of this "reply", and declared that terms were omitted in two formulae. In this reply these omissions are described as being justified, and it is pointed out that in all cases in which it was found necessary, these terms were mentioned. In this connection a formula is specifically mentioned.

SUBMITTED: November 25, 1958

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9(3) SOV/56-37-2-36/56

AUTHORS: Lifshits, I. M., Kaganov, M. I.

TITLE: On Electron Resonance in Crossed Electric and Magnetic Fields

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 2(8), pp 555-556 (USSR)

ABSTRACT: An electron placed into crossed electric and magnetic fields has a drift motion in the direction perpendicular to the electric and magnetic field. The drift velocity, i.e. the mean rate of motion of the particle (the initial speed not considered) is given by $\vec{v} = cH^{-2}\left[\vec{E}\,\vec{H}\right]$. Besides, the electron oscillates in the direction of the electric field, the frequency of these oscillations being eH/mc. This means that in crossed fields the frequency is independent of the electric field strength. The behavior of the electron is greatly different in metals and semiconductors, where the complicated dispersion law has a pronounced influence upon the character of conductivity electron motion. This study proceeds from the classical equation - the generalized Lorentz equation: $d\vec{p}/dt = e\left\{\vec{E} + c^{-1}\left[\vec{v}\,\vec{H}\right]\right\}$, $\vec{v} = \partial\varepsilon/\partial\vec{p}$. The

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integrals of motion are then: $\varepsilon^*(\vec{p}) \equiv \varepsilon(\vec{p}) - \vec{v}_o\vec{p} = \text{const}$, $\vec{v}_o = cH^{-2}\left[\vec{E}\,\vec{H}\right]$, $p_z = \text{const}$. The z-axis is chosen as the direction of the magnetic field, $\vec{v}_o$ being the mean rate of motion of the electron. The motion of a particle in crossed fields obeying the dispersion law $\varepsilon = \varepsilon(\vec{p})$ can be regarded as the motion of the particle in a magnetic field alone obeying the dispersion law $\varepsilon^*(\vec{p}) = \varepsilon(\vec{p}) - \vec{v}_o\vec{p}$. Earlier results can easily be referred to this case. The period of gyration T^* of an electron in a closed orbit is $T^* = -(c/eH)\,\partial S^*/\partial\varepsilon^*$, where S^* denotes the surface bounded by the second equation, which naturally also depends upon the electric field strength. This dependence, however, does not occur with a quadratic dispersion law. The dependence of the period of gyration upon the electric field strength is characteristic of electrons with a complicated (not quadratic) dispersion law. The explicit period versus electric field strength function can be determined only if the dispersion law is actually given. If $E/H \ll 1$, $\Delta T/T \sim (c/v)(E/H)$ is obtained, T denoting the period of gyration in the magnetic

On Electron Resonance in Crossed Electric and Magnetic Fields

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field. If the gyration frequency of the electron is known there is no difficulty in writing down the distances between the quantized energy levels in a quasiclassical approximation $\Delta\varepsilon^* = \hbar\omega^* = 2\pi|e|\hbar H/c(\partial S^*/\partial\varepsilon^*)$. The non-quadratic dependence of the energy upon the components of the quasimomentum is frequently found at the edge of the conduction band, and it is often a result of the symmetry of the crystal. Such phenomena will very probably not be observed in metals. There are 7 references, 4 of which are Soviet.

ASSOCIATION: Tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED: May 21, 1959

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I. M. Lifshits

24(0) SOV/53-67-4-7/7

AUTHOR: Chentsov, R.

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ye Vsesoyuznoye soveshchaniye po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi; it was organized by the Otdeleniye fiziko-matematicheskikh nauk Akademii nauk SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, Gruzinskaya SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University imeni Stalin). The Conference was attended by about 300 specialists from Tbilisi, Moscow, Khar'kov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered which were divided according to research fields. - I. Liquid Helium. Reports were delivered by the researchers of the Laboratoriya nizkikh temperatur TGU (Laboratory for Low Temperatures of Tbilisi State University) under the supervision of E. L. Andronikashvili: D. S. Tsakadze, Yu. G. Mamaladze and S. G. Matinyan spoke about the investigation of the damping of rotational oscillations of a single disk in He II in dependence on the rotation rate. G. A. Gamtsemlidze spoke about the influence exercised by the state of the disk surface on critical rate and on the damping of its oscillations in the transcritical range. V. P. Peshkov (IFP AN SSSR - Institute for Physical Problems AS USSR) spoke about further investigations of the boundary between superfluid and non-superfluid helium (discovered by himself) in a heat flow. This boundary characterizes the density- and temperature jump. Kuang, Wei-yen, Y. N. Zinov'yeva and V. P. Peshkov spoke about investigations at extremely low temperatures (down to 0.5°K) which were attained by the method of the evacuation of

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He^3-vapors. Kuang, Wei-yen investigated in the interval 0.57 - 2.07°K the phenomenon of the temperature jump (discovered by P. L. Kapitsa in 1941) on the boundary of a solid (in this case Cu) by means of He II; for the thermal resistance not the T^3-law but a T^n-law holds, where $n=2.5\pm0.1$. Zinov'yeva and Peshkov investigated, among other things, also the phase

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diagram of He^3 dissolved in He^4 (20 - 89%). V. L. Ginzburg (FIAN) gave a report on the phenomenological theory of He II in the region of the λ-point in consideration of quantum effects (the theory was developed by himself and by L. P. Pitayevskiy). B. T. Geylikman (IAE AN SSSR - Institute for Atomic Energy, AS USSR) delivered a short report on the theory of phase transition in liquid He^4. I. M. Lifshits and D. G. Sanikidze (KhFTI AN USSR - Khar'kov Physicotechnical Institute AS UkrSSR) investigated the melting of solid He^3 on the basis of Landau's theory of the Fermi-fluid and found that melting pressure as a function of temperature has a minimum at 0.5°K (Pomeranchuk-effect). The comprehensive discussion was held under the supervision of P. L. Kapitsa.-

I. M. Lifshits

24(0) SOV/53-67-4-7/7

AUTHOR: Chentsov, R.

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ye Vsesoyuznoye soveshchaniye po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi; it was organized by the Otdeleniye fiziko-matematicheskikh nauk Akademii nauk SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, Gruzinskaya SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University imeni Stalin). The Conference was attended by about 300 specialists from Tbilisi, Moscow, Khar'kov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered which were divided according to research fields.

II. Supraconductivity. 13 lectures were delivered on this field of which two were experimental and the others theoretical. Reports on experimental investigations of supraconductivity were delivered by Yu. V. Sharvin and V. F. Gantmakher (IFP) and N. V. Zavaritskiy (IFP). The former investigated the structure of the intermediate state in monocrystals of pure tin, the latter measured the thermal conductivity of differently shaped orientated cylindrical gallium samples at 0.1 - 4.2°K. A. A. Abrikosov, L. P. Gor'kov and I. M. Khalatnikov (IFP) theoretically investigated the behavior of a superconductor in the high-frequency field. V. L. Ginzburg and G. F. Zharkov (FIAN) dealt with the microscopical theory, and Ginzburg discussed among other things the part played by fluctuations in phase transitions of the second kind. I. M. Lifshits (KhFTI) showed that it follows from the modern theory of supraconductivity in consideration of the anisotropy of metals that, in principle, the existence of supraconductors is possible which are supra-conductive only within a limited range of temperature (and not at all temperatures below the critical ones). B. T. Geylikman and V. Z. Kresin (IAE) investigated the electron- and phonon thermal conductivity of supraconductors by means of the microscopical theory at temperatures that are not very near absolute zero. M. V. Buykov and L. E. Gurevich (FTI AN SSSR) spoke about the surface energy on the boundary between the supraconductive and normal phases. D. N. Zubarev and Yu. A Tserkovnikov (Matematicheskiy institut AN SSSR - Mathematics Institute AS USSR) dealt with the thermodynamics of the supraconductive state (Froehlich-model). V. V. Tolmachev (MIAN) investigated the problem of collective excitations in a supraconductor. D. V. Shirkov (Ob"yedinennyy institut yadernykh issledovaniy - Joint Institute of Nuclear Research) spoke about consideration of Coulomb-interaction of electrons in semiconductors. The problem of consideration of the Coulomb interaction was discussed by Chen' Ch'un-hsien and Chou, Hsi-hsin (MGU).

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I. M. Lifshits

24(0)
AUTHOR: Chentsov, R. SOV/53-67-4-7/7

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ye Vsesoyuznoye soveshchaniye po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi; it was organized by the Otdeleniye fiziko-matematicheskikh nauk Akademii nauk SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, Gruzinskaya SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University imeni Stalin). The Conference was attended by about 300 specialists from Tbilisi, Moscow, Khar'kov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered which were divided according to research fields.

III. Galvanomagnetic phenomena. (10 lectures). I. M. Lifshits and V. D. Peschanskiy (KhFTI, Khar'kov Physico-technical Institute, Khar'kov University) showed that the most important part in connection with the galvanomagnetic properties of metals is played by the concrete form of the Fermi surface of conductivity electrons. N. Ye. Alekseyevskiy (IFP) spoke about experiments he carried out together with Yu. P. Gaydukov. He investigated the variation of the resistance in the transversal magnetic field at helium temperatures of Au, Cu, Pb, Ta, Ga, Ni and (together with T. I. Kostina) of Bi. Ye. S. Borovik and V. G. Volotskaya (KhFTI) investigated the galvanomagnetic properties at low temperatures of chromium and zirconium and found that the resistance of chromium grows with field strength without attaing a saturation value. L. S. Kan and B. G. Lazarev (KhFTI) investigated the resistance minimum in gold at low temperatures and found that if the sample is heated, the minimum disappears. Yu. P. Gaydukov (IFP) said in this connection in the course of the discussion that the minimum effect does not occur in gold in the case of very pure samples; the disappearance of the minimum is explained by the plastic deformation of the sample at helium temperatures. M. Ya. Azbel' (KhFTI) gave a report of his work in connection with the quantum theory of the high-frequency resistance of metal in a constant magnetic field at low temperatures. M. I. Kaganov and V. M. Tsukernik (KhFTI) spoke about a theoretical investigation of the influence exercised by thermoelectric forces upon the skin effect in various conductors. B. I. Verkin and B. N. Aleksandrov (KhFTI) spoke about measurements of the electric resistance of thin wires made from highly-pure tin, indium and cadmium, and computed the free length of path at 4.2°K in these metals as amounting to 1/3 to 2/3 mm. N. B. Brandt (MGU) and B. I. Verkin and I. M. Dmitrenko (KhFTI) investigated the influence exercised by the hydrostatic pressure (of 1000 atmospheres absolute pressure) upon the behavior of metals at low temperatures and investigated the quantum oscillations of the magnetic susceptibility of bismuth at 1.6 - 4.2°K. G. Ye. Zil'berman and A. M. Kosevich (KhFTI) gave a theoretical explanation of the fact that already relatively small deformations exercise considerable influence upon oscillation effects in metals. IV. Magnetism. A. S. Borovik-Romanov (IFP) delivered a report on investigations he carried out of the anisotropy of the weak ferromagnetism in monocrystal samples of the antiferromagnetic $MnCO_3$ (the effect of anisotropy was predicted by the thermodynamical theory developed by Dzyaloshinskiy). In the course of the discussion R. A. Alikhanov (IFP) spoke about neutronographical investigations he carried out of the magnetic structure of $MnCO_3$ and $FeCO_3$ at low temperatures. P. L. Kapitsa stressed the importance of the method based upon Dzyaloshinskiy's theory. N. M. Kreynes (VNIIFTRI), whose lecture was read by A. S. Borovik-Romanov, reported on measurements carried out by him (in the IFP) of the magnetic anisotropy of the antiferromagnetic $CuSO_4$- and $CoSO_4$-monocrystals. Ye. A. Turov (IFM AN SSSR, Sverdlovsk) spoke about his theore-

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21(1), 24(5) SOV/53-69-3-3/6

AUTHORS: Lifshits, I. M., Kaganov, M. I.

TITLE: Some Problems of the Electron Theory of Metals. I. Classical and Quantum Mechanics of Electrons in Metals

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 69, Nr 3, pp 419-458 (USSR)

ABSTRACT: The first part of this detailed survey comprises 7 paragraphs. Paragraph 1: Introduction (posing of the problem; fundamental works by Bloch and Peierls, Bloch's model, Fermi statistics; quantum theory of the Fermi fluid by L. D. Landau; semiphenomenological theory, energy spectrum of free electrons, dispersion law $\varepsilon = \varepsilon(\vec{p})$; the entire article consists of 3 parts: mechanics of conductivity electrons, statistical thermodynamics of electron gas, kinetics (galvanomagnetic- and resonance phenomena); a large part of the results mentioned here is taken from the works of a group of theoretical physicists from Khar'kov. Paragraph 2: The geometry of the isoenergetic electron surfaces (representation of the dispersion law; the periodic function $(\varepsilon\vec{p})$ describes the closed isoenergetic surfaces; representation twodimensional (Fig 1) and threedimensional (Fig 2); special cases for complicated dispersion law, spatial (Fig 3); open

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isoenergetic surfaces, discussion, representation of various types (Fig 4)). Paragraph 3: Classical mechanics of particles with arbitrary dispersion law (discussion of the conditions necessary for the classical treatment of a problem; investigation of metal in electric or magnetic fields, both general and for the case of a constant homogeneous electric and a constant homogeneous magnetic field, mathematical description, illustrated by figures 6-9. Paragraph 4: Collisions of quasiparticles. Scattering. (Collisions: interaction of electrons with local periodicity perturbations which lead to variations of momentum and energy of the electron; description of possible inhomogeneities and their effects.) Paragraph 5: Quasiclassical energy levels (quantum-mechanical description of conductivity electrons; diamagnetism of electron gas, De Haas - Van Alfen effect, theoretical investigation of the behavior of electrons in a magnetic field according to Landau; influence of the crystal lattice, quantization of momentum and energy, setting up of the equation describing the trajectories (Fig 11); the quantization of electron energy manifests itself in a peculiar behavior of

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the electron gas at low temperatures in the magnetic field - in oscillation- and resonance effects (e.g. Shubnikov - De Haas effect, cyclotron resonance); the latter are described). Paragraph 6: Quantum mechanics of the electron with arbitrary dispersion law. (Representation of electron behavior in the metal by means of quasimomentum and energy zone ($a,\vec{p}$ - representation) detailed description of the theory; discussion of the problems: investigation of state variations (wave function), investigation of the steady solution (determination of the energy levels of the particle); demonstration of treatment on the basis of two simple examples.) Paragraph 7: Quantum theory of electron scattering with arbitrary dispersion law (investigation of scattering on local inhomogeneity; definition of scattering center, derivation of an asymptotic expression for the perturbed wave function by means of the perturbation theory, investigation of the wave surface of the scattered electron, definition of scattering cross section). All problems are dealt with in a clear and intelligible manner after the manner of text books. There are 16 figures and 28 references, 19 of which are Soviet.

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SOKOLOVSKIY, Yuriy Iosifovich, kand.pedagog.nauk, dotsent; LIFSHITS, I.M., otv.red.; KURILOVA, T.M., red.; TROFIMENKO, A.S., tekhn.red.

[Elementary explanation of the theory of relativity] Teoriia otnositel'nosti v elementarnom izlozhenii. Khar'kov, Izd-vo Khar'kovskogo gos.univ., 1960. 173 p. (MIRA 13:12)

1. Chlen-korrespondent AN SSSR (for Lifshits).
(Relativity (Physics))

LIFSHITS, I.M.; PESCHANSKIY, V.G.

Galvanomagnetic characteristics of metals with open Fermi surfaces. Part 2. Zhur. eksp. i teor. fiz. 38 no.1:188-193 Jan '60. (MIRA 14:9)

1. Fiziko-tekhnicheskiy institut AN Ukrainskoy SSR i Khar'kovskiy gosudarstvennyy universitet.
(Fermi surfaces) (Magnetic fields)

83598
S/056/60/038/005/031/050
B006/B063

24.2100

AUTHOR: Lifshits, I. M.

TITLE: Anomalous Electron Characteristics of a Metal in the High-pressure Range

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1569-1576

TEXT: Within the range of high pressures and low temperatures, characteristic anomalies of the thermodynamic and kinetic quantities occur, which are related to the singularities in the energy spectrum of conduction electrons. The energy-state density $\nu(\varepsilon) = dN(\varepsilon)/d\varepsilon$ of the conduction electrons is related to the shape of isoenergetic surfaces in the momentum $\varepsilon(\vec{p}) = \varepsilon$. The energy values of $\varepsilon = \varepsilon_k$ at which the topology of these surfaces (Fermi surfaces) varies - as, e.g., in the manner illustrated in Fig. 1 - correspond to state-density singularities. The critical surface $\varepsilon(\vec{p}) = \varepsilon_k$ has singularities, in the neighborhood of which electron dynamics has a somewhat peculiar character; the metal shows anomalies of the thermo-

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dynamic and kinetic characteristics of the electron gas. These anomalies may be theoretically investigated by means of lattice deformation (uniform compression in the case of high pressures) and impurity or admixture concentrations as steady parameters. The present paper describes an investigation of the properties of a metal in the region of singularities of the "electron transition" (variation of the topology of the Fermi surface). First, the author studies the anomalies of the thermodynamic quantities for the case of zero temperature, in which the singularities of the thermodynamic characteristics are related to those of $\nu(\varepsilon)$. These singularities are blurred with rising temperature. Several anomalies are studied, and expressions are derived for the thermodynamic potential, the free energy, etc. Formulas (11) - (13) express the anomalies of the electronic specific heat, the coefficient of electronic compressibility, and the $\partial p/\partial T$ coefficient. The singularities of the two last-mentioned cases, observed in the range $z = 0$ ($z \sim p-p_k$), are illustrated in Fig. 3 (a and b). The anomaly of paramagnetic susceptibility near $z = 0$ is shown in Fig. 4. At the end of this part, the author determines the anomalous spin paramagnetism at $T = 0$. It is expressed by formula (20). The second part of the present paper deals with an investigation of the anomalies of the galvanomagnetic characteristics.

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B029/B077

24.7700 (1043, 1143, 1557)

AUTHORS: Alekseyevskiy, N. Ye., Gaydukov, Yu. P., Lifshits, I. M., Peschanskiy, V. G.

TITLE: The Fermi Surface of Tin

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1201 - 1214

TEXT: The author starts by analyzing the geometrical conditions of the Fermi surface for tetragonal crystals. The following expression is used for the dispersion law $\varepsilon(\vec{p})$:

$$\varepsilon(\vec{p}) = A_0 - A_1 \cos\frac{cp_z}{\hbar} - A_2 \cos\frac{cp_z}{2\hbar}\left(\cos\frac{ap_x}{2\hbar} + \cos\frac{ap_y}{2\hbar}\right)$$

$$- A_3 \cos\frac{ap_x}{2\hbar}\cos\frac{ap_y}{2\hbar} - A_4\left(\cos\frac{ap_x}{\hbar} + \cos\frac{ap_y}{\hbar}\right).$$

c denotes the lattice constant along the tetragonal axis [001], and a is the lattice constant

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along the binary axes [100] and [010]. Detailed statements are supplemented by illustrating the transformation in stereographic projections along the direction of the magnetic field. The second part of this paper deals with determining the directions of plane sections of an open Fermi surface. There are several types of current diagrams with $\varrho_{\vec{H}} = \text{const}(\alpha)$, where α denotes the angle formed by the current and the open cross section or a certain crystallographic axis ($\vec{J} \perp \vec{H}$). Using these polar diagrams of the current intensity it is possible to determine whether the cause of the quadratic increase of resistance for a given direction of the magnetic field is the compensation of volumes ($V_1 = V_2$) or the presence of open trajectories, and it is possible to determine the direction of these trajectories. Two special cases are then investigated. The experimental results are given and discussed in the third part of this paper. Tin was produced by zone melting at the tekhnologicheskiy otdel IFP AN SSSR (Institute of Physical Problems of the AS USSR, Department of Technology). The resistance diagrams of all tin specimens whose axes enclose a small angle with the axis [001] ($0^\circ < \vartheta' \lesssim 30^\circ$) have the form of eight-leafed rosettes. If this angle

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is increased, new and very small minima will appear; for these minima no saturation of resistance in the magnetic field was observed either. The polar diagrams for the case $\vartheta' \gtrsim 50^{\circ}$ are two-leafed rosettes. Further details are given. A single Fermi surface cannot explain the current diagrams of the type III. (Such a diagram is obtained by employing the method of volume compensation, $V_1 = V_2$). Tin has also other isoenergetic surfaces, which make it possible to explain such a compensation of volumes. At least two sections of the energy spectrum $\varepsilon(\vec{p})$ are essential to the Fermi surface of tin. The second isoenergetic surface can be closed or open. The two variants of the Fermi surface of tin can be made to agree with the stereographic projection along the main directions of the magnetic field. The open surface represents holes, and the closed one, electrons. The shape of the tubes (the connecting parts between the planes) is very similar to a cylinder. A quadratic increase of resistance is predominant for tin in a magnetic field. The one-leafed characteristic of the Fermi surface could be used to explain the specific features of the galvomagnetic properties of lead, cadmium, zinc, and other metals with open Fermi surfaces.

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The Fermi Surface of Tin

Academician P. L. Kapitsa is thanked for his interest. There are 6 figures, 3 tables, and 6 Soviet references.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems, Academy of Sciences USSR)

SUBMITTED: June 17, 1960

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LIFSHITS, I.M.; TANATAROV, L.V.

Elastic interaction of impurity atoms in crystals. Fiz. met. i metalloved. 12 no.3:331-337 S '61. (MIRA 14:9)

1. Fiziko-tekhnicheskiy institut AN USSR.
(Crystal lattices)

LIFSHITS, I.M.

Quantum cyclotron resonance in metals. Zhur. eksp. i teor. fiz. 40 no.4:1235-1236 Ap '61. (MIRA 14:7)

1. Khar'kovskiy gosudarstvennyy universitet.
(Cyclotron resonance) (Fermi surfaces)

LIFSHITS, I.M.; SLUTSKIN, A.A.; NABUTOVSKIY, V.M.

Characteristics of the motion of charged quasi-particles in a variable and inhomogeneous electromagnetic field. Zhur.eksp.i teor.fiz. 41 no.3:939-948 S '61. (MIRA 14:10)

1. Fiziko-tekhnicheskiy institut AN USSR.
(Dynamics of a particle)

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S/020/61/137/003/009/030
B104/B214

24,7700 (1144, 1160, 1469)

AUTHORS: Lifshits, I. M., Corresponding Member of the AS USSR, Slutskin, A. A., and Nabutovskiy, V. M.

TITLE: Scattering effect of charged quasi-particles at singular points in the p-space

PERIODICAL: Doklady Akademii nauk SSSR, v. 137, no. 3, 1961, 553-556

TEXT: The kinetic and resonance properties of metals and semiconductors are related to the dynamics of quasiparticles such as conduction carriers. This scattering effect of the quasi-particles is studied which is connected with the singularities of the dispersion law and not with the existence of a scattering center of force. In the presence of a magnetic field varying slowly in space and time or a weak longitudinal electric field the parameters ε (particle energy) and p_H (projection of the momentum in the direction of the magnetic field) are not constant. However, p_H and ε vary sufficiently slowly to allow the motion in the p-space

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